THE
NEW GRESHAM
ENCYCLOPEDIA

VOLUME VI

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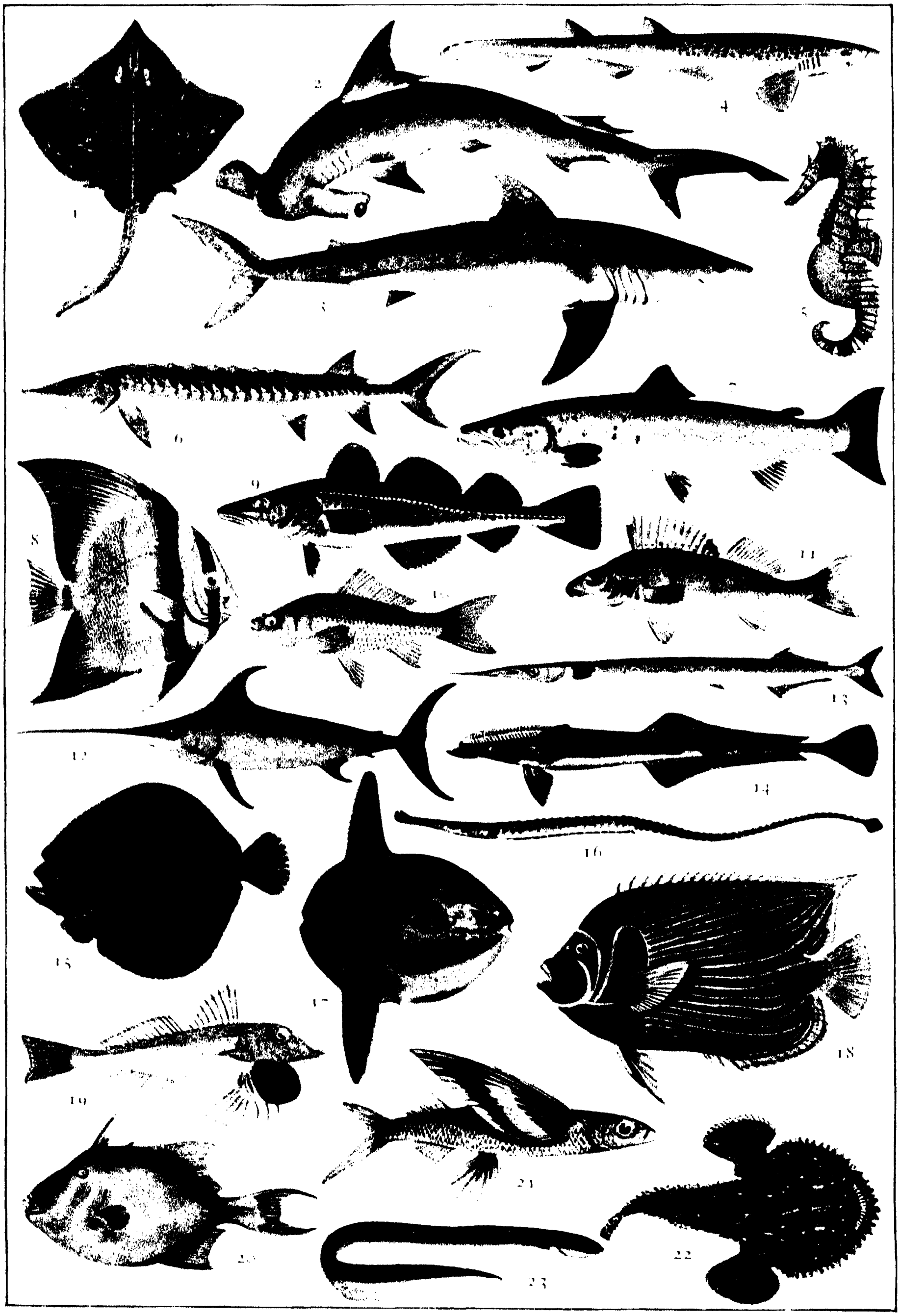
ICHTHYOLOGY



1, Skate. 2, Hammer-head Shark. 3, Great White Shark. 4, Dog-fish. 5, Sea-horse. 6, Sturgeon. 7, Salmon. 8, Sea-bat. 9, Cod. 10, Golden Carp. 11, Perch. 12, Sword-fish. 13. Gar Pike. 14, Sucking fish. 15, Turbot. 16, Pipe-fish. 17, Sun-fish. 18, Emperor-fish. 19, Gurnard. 20, File-fish. 21, Flying-fish. 22, Angler fish. 23, Electric Eel.

THE NEW·GRESHAM ENCYCLOPEDIA

VOLUME VI

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KEY TO PRONUNCIATION

The method of marking pronunciations here employed is either (1) by marking the syllable on which the accent falls, or (2) by a simple system of transliteration, to which the following is the Key:—

VOWELS

ā, as in f*a*te, or in b*a*re.
ä, as in *a*lms, Fr. *â*me, Ger. B*a*hn=á of Indian names.
ȧ, the same sound short or medium, as in Fr. b*a*l, Ger. M*a*nn.
a, as in f*a*t.
a̤, as in f*a*ll.
a, obscure, as in rur*a*l, similar to *u* in b*u*t, ė in h*e*r: common in Indian names.
ē, as in m*e*=*i* in mach*i*ne.
e, as in m*e*t.
ė, as in h*e*r.
ī, as in p*i*ne, or as *ei* in Ger. m*ei*n.
i, as in p*i*n, also used for the short sound corresponding to ē, as in French and Italian words.
eu, a long sound as in Fr. j*eû*ne=Ger. long *ö*, as in S*ö*hne, G*ö*the (Goethe).
eu, corresponding sound short or medium, as in Fr. p*eu*=Ger. *ö* short.
ō, as in n*o*te, m*oa*n.
o, as in n*o*t, s*o*ft—that is, short or medium.
ö, as in m*o*ve, tw*o*.
ū, as in t*u*be.
u, as in t*u*b: similar to ė and also to *a*.
ṳ, as in b*u*ll.
ü, as in Sc. ab*u*ne=Fr. *û* as in d*û*, Ger. *ü* long as in gr*ü*n, B*ü*hne.
u̇, the corresponding short or medium sound, as in Fr. b*u*t, Ger. M*ü*ller.
oi, as in *oi*l.
ou, as in p*ou*nd; or as *au* in Ger. H*au*s.

CONSONANTS

Of the *consonants*, **b**, **d**, **f**, **h**, **j**, **k**, **l**, **m**, **n**, **ng**, **p**, **sh**, **t**, **v**, **z**, always have their common English sounds, when used to transliterate foreign words. The letter **c** is not used by itself in re-writing for pronunciation, **s** or **k** being used instead. The only consonantal symbols, therefore, that require explanation are the following:—

ch is always as in ri*ch*.
d, nearly as *th* in *th*is=Sp. *d* in Ma*d*ri*d*, &c.
g is always hard, as in *g*o.
h represents the guttural in Scotch lo*ch*, Ger. na*ch*, also other similar gutturals.
n̦, Fr. nasal *n* as in bo*n*.
r represents both English *r*, and *r* in foreign words, which is generally much more strongly trilled.
s, always as in *s*o.
th, as *th* in *th*in.
th, as *th* in *th*is.
w always consonantal, as in *w*e.
x=ks, which are used instead.
y always consonantal, as in *y*ea (Fr. *ligne* would be re-written lēny).
zh, as *s* in plea*s*ure=Fr. *j*.

THE NEW GRESHAM ENCYCLOPEDIA

VOLUME VI

Grinding, a general term for operations whereby materials are milled, crushed, pulverized, shaped, or reduced in size by the forces of attrition, abrasion, and impact. Rocks and minerals may be disintegrated between heavy steel jaws, one being slightly oscillated, as in the Blake stone-breaker. For fine grinding or milling gold-bearing quartz, batteries of stamps are used, the mineral being crushed by the fall of a heavy stamp shoe, alternately raised and released by a cam. In the Griffin type of mill a heavy wheel, suspended pendulum fashion, swings around the periphery of a pan, and crushes the material as in a simple pestle and mortar. In edge-wheel or pan mills heavy broad-faced wheels roll over the floor of the pan containing the material. In 'ball-and-tube' mills the material is fed into rotating or tumbling steel barrels, sometimes lined with quartzite, containing loose flint or steel balls. Grinding may be done wet or dry, according to circumstances. For softer materials, such as cereals, flat millstones, rotating one above the other, are employed. This arrangement is one of great antiquity. Cereals may be disintegrated to a very fine state of division by the impact of quickly-moving projections of rotating discs, between which the grain is passed. Paints, chocolate, and similar substances are ground and mixed between rollers rotating at slightly different speeds and reciprocating endwise. Materials are reduced in size by grinding with loose abrasives or abrasive wheels, usually with water. At slow speeds the abrasive must be at least as hard as the material. Thus diamonds are ground on lead laps or rotating discs charged with diamond dust. Brittle substances, such as glass, are ground as the result of a surface splintering action by means of loose abrasives, such as carborundum, corundum, emery, and sand, applied to the surface of rotating cast-iron discs; but abrasive wheels are sometimes employed. Metals are shaped or ground by abrasive wheels associated with many specialized machines—universal, cylindrical, internal, surface, tool, and drill. The grains or grits of abrasive of various grades are held together by vitrified bonds of fused clay, silica bonds of clay and water-glass fused at a lower temperature, and elastic bonds containing shellac and gums. *Lapping* is the operation of reducing sizes by very small amounts, or trueing, by grinding with fine loose abrasive mixed with oil or water. At high speeds a hard material can be ground with a softer; thus the ends of hardened armour plates are ground to size by quickly rotating blocks of sandstone or other substances. In *sand-blasting*, material is removed by the impact of grains of sand or fine chilled shot impelled by a stream of compressed air.—BIBLIOGRAPHY: Sir E. Thorpe, *Dictionary of Applied Chemistry*; R. B. Hodgson, *Emery Grinding Machinery*.

Grindstone, a cylindrical stone, on which sharpening, cutting, and abrasion are effected by the convex surface while the stone is revolving on its axis. They are made of sandstone, or sandstone grit of various degrees of fineness. Good stones are obtained in various parts of England, especially from the coal districts of Northumberland, Newcastle grindstones being especially famous. The Sheffield grindstone, used for grinding files and the like, is obtained from Hardsley, about 14 miles north of Sheffield. Artificial grindstones have been successfully tried.

Griqualand East, a district of Cape Province, South Africa, lying south of Natal between Pondoland and Basutoland; fertile and suited for stock-raising. It was incorporated with Cape Colony in 1874. Area, 6602 sq. miles. Pop. 249,088 (including 5866 whites).

Griqualand West, a district of Cape Province north of the Orange River, and west of the Orange Free State; 180 miles from east to west, and 120 from north to south; area, about 15,179 sq. miles. The prevailing character of the surface is that of undulating grassy plains suitable for grazing. Previous to the discovery of the diamond fields in the basin of the Vaal River, Griqualand was little known. In 1870 large finds of diamonds in that district began to attract wide notice, and in 1871 Waterboer, the Griqua chief, ceded all his rights to the British Government, and the territory was incorporated with Cape Colony. The chief centre of the diamond-mining industry, and the seat of government, is Kimberley. The annual value of the diamonds produced usually reaches about £4,000,000. The Griquas are a mixed race sprung from the intercourse of the Boers with Hottentot women. Pop. 108,500 (including 32,570 whites).

Grisi (grē′sē), Giulia, a celebrated Italian vocalist, born at Milan 1811 or 1812. After having studied music at Bologna, and made her début in Rossini's *Zelmira,* she appeared at Milan as Norma. She acquired great celebrity at Paris, in England, and America, and was at the height of her fame between 1834 and 1849. In 1836 she married Mario, the great tenor singer. Her voice gave way in her later years, and she died at Berlin in 1869. Her principal character was Norma.

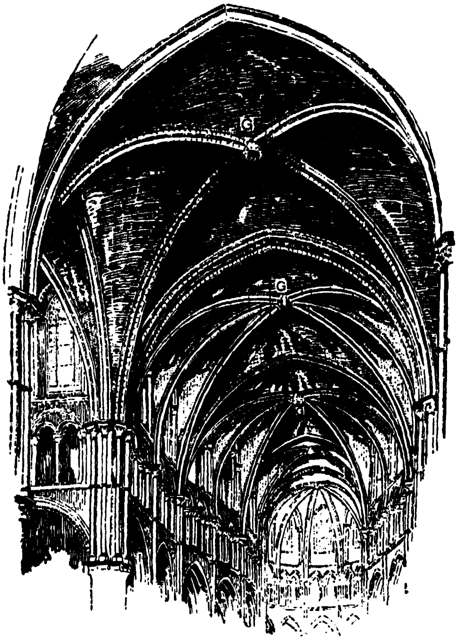
Gris-Nez (grē-nā), **Cape,** a headland, north-west extremity of France, department of Pas-de-Calais, the nearest point of the French shore to that of Britain, the distance being barely 21 miles. It has a revolving light, 195 feet high.

Grisons (grē-sōṇ; Ger. *Graubünden*), the largest and most easterly canton of Switzerland, bordering on Austria and Italy; area, 2773 sq. miles. Its boundaries and interior consist almost entirely of mountain chains, including more than twenty peaks above 9000 feet. The canton may be regarded as embracing three great valley districts, of which the Upper and Lower Engadine (Inn Valley) attain considerable breadth. The Inn, which flows to the Danube, and the Vorder and Hinter Rhine, are the principal rivers. The lakes are numerous, and many of them present scenery of the most magnificent description. The climate varies greatly, ranging from the perpetual winter of the mountains to the almost Italian air of some of the valleys. The canton is in general pastoral, feeding large numbers of cattle and sheep. The mountain forests supply much timber. A considerable transit trade is carried on between Italy and Germany. The canton was admitted into the Confederation as late as 1803. Both the Protestant and the Roman Catholic religion are established. The language of the public Acts is German, and the people speak German, Romansch, or Italian. Pop. (1920), 118,263.

Groat (Du. *groot,* great, thick), an English silver coin, coined by Henry III in 1249, and by Edward III in 1351. It was equal to fourpence in value. A coin of this value, the *fourpenny-piece,* was revived in 1835, but none have been struck since 1856, and all are now withdrawn from circulation. The Scots groat was issued in 1358, and the Irish groat in 1460.

Grodno, a town in Lithuania, formerly the capital of a Russian government or province of the same name, on the Niemen, 160 miles north-east of Warsaw, a poorly-built place, the principal edifice being a palace erected by Alexander III. The manufactures consist of woollen, linen, and silk goods, and fire-arms. The fortress was taken by the Germans in Sep., 1915. The possession of Grodno was still disputed by Russia and Poland in 1921. Pop. 62,000.—The province of Grodno has an area of 14,896 sq. miles, largely occupied by pine forests and swamps. Pop. 2,000,000.

Groin, the angular curve made by the intersection of two semi-cylinders or arches. It is either regular or irregular: *regular,* as when the intersecting arches are of the same diameters and heights; and *irregular,* when one of the arches is semi-circular, and the other semi-elliptical. In Gothic architecture groins are always ribbed.



Groins G G G. Choir, Canterbury Cathedral

Gromwell, the name of plants of the genus Lithospermum, nat. ord. Boraginaceæ, containing a number of widely-distributed species, three of which are natives of Britain. The seeds of *L. officinale* are occasionally used as a diuretic.

Groningen (grō′ning-en), a town of Holland, capital of a province of the same name, situated on the River Hunse, here converted into a canal, 92 miles north-east of Amsterdam. It is a rich place, adorned with many excellent buildings, and has numerous canals crossed by bridges. The principal edifices are the cathedral, a fine exchange, and the university. It has manufactures of white lead and soap, oil, fulling, and sawmills, and an excellent harbour, with an active trade. Pop. (1919), 89,030.—The province forms the north-eastern portion of Holland; area, 881 sq. miles. It is protected against the encroachments of the sea by dykes, is very level, and is intersected by innumerable canals. The inhabitants, 363,077 (1919), nearly all belong to the Calvinistic Church.

Grono′vius (properly *Gronov*), the name of several Dutch classical scholars.—(1) Johann Friedrich, born at Hamburg in 1611, succeeded Daniel Heinsius as professor of belles-lettres at Leyden in 1658, and died there in 1671. His editions of Livy, Statius, Justin, Tacitus, Gellius, Phædrus, Seneca, Sallust, Pliny, and Plautus are valuable.—(2) His son Jakob, born at Deventer in 1645, studied there and at Leyden. He afterwards became professor of belles-lettres at that university, and died in 1716. He edited Tacitus, Polybius, Herodotus, Pomponius Mela, Cicero, and Ammianus Marcellinus, and compiled a *Thesaurus Antiquitatum Græcarum* (Leyden, 1697, 13 vols. fol.).—(3) His son Abraham, born at Leyden 1694, edited Justin, Pomponius Mela, Tacitus, and Ælian. He died at Leyden in 1775.

Groote Eylandt (grō′te ī′lant; ‘ great island ’), the largest island in the Gulf of Carpentaria, north of Australia, belonging to the colony of South Australia; greatest length and breadth, 40 miles each.

Gros (grō), Antoine-Jean, Baron, French historical painter, born at Paris in 1771. He studied art under David, attracted the notice of Napoleon by his picture *The Victor of Arcola*, and became an honorary staff officer in the French army. In 1804 he produced his *Plague at Jaffa*, showing Napoleon visiting the sick, a work crowned at the Louvre. He painted also battle scenes and a number of portraits; but his chief work is probably the cupola of St. Geneviève at Paris, exhibiting the saint protecting the throne of France, represented by Clovis, Charlemagne, St. Louis, and Louis XVIII. The artist received for it the sum of 100,000 francs. His work shows more feeling for movement and a bolder use of colour than that of most of his contemporaries. The rise of the Romantic school and the criticism levelled at his work so affected his mind that he drowned himself in the Seine in 1835.

Grosbeak (Fr. *grosbec*), a general popular name for several finches and other perching birds possessing unusually large beaks, e.g. the hawfinch (*Coccothraustes vulgāris*); other examples are the pine grosbeak (*Pyrrhula enucleātor*), scarlet grosbeak (*P. erythrina*), and the American cardinals (species of Cardinalis).

Groschen (grō′shen), a name for German coins of which the oldest known were struck in Trèves in 1104. In 1525 the groschen was divided into twelve pfennige. Afterwards, in the currency system existing up till 1872, the groschen was a silver coin = 1⅕*d*. sterling, there being 30 to the *thaler* of about 3*s*. sterling.

Grose, Francis, an English antiquary, born in 1731, died in 1791. Having dissipated the fortune inherited from his father, he turned his attention to the study of antiquities. In 1773 he commenced the publication in numbers of his *Views of Antiquities in England and Wales*. In 1789 he made a tour in Scotland for the purpose of illustrating the antiquities of that country. Before completing it, however, he proceeded to Ireland, with the view of collecting its antiquities, but was suddenly carried off by apoplexy. His name is now perhaps chiefly remembered from his connection with Burns, who wrote his *Tam o' Shanter* for him. He was the original " chield amang you taking notes ". Captain Grose also wrote a *Treatise on Ancient Armour and Weapons*, a *Classical Dictionary of the Vulgar Tongue*, and other works.

Gross, in opposition to *net*, is applied to merchandise, including the weight of that in which it is packed. Thus we say, ‘ The bag of coffee weighs 9 cwt. *gross* ’, that is, including the weight of the bag.

Grossenhain (grōs′en-hīn), a town in Saxony, 20 miles N.W. of Dresden, on the left bank of the Röder. Woollen and cotton goods are manufactured. Pop. 12,200.

Grosseteste, Robert, an eminent English scholar and prelate, was born about the year 1175, died in 1253. He studied first at Oxford, and then went to Paris, where he mastered the Hebrew and Greek languages. On his return to England he became lecturer in the Franciscan school at Oxford, and acquired a great reputation for his linguistic abilities and his skill in logic. In 1235 he was appointed Bishop of Lincoln, but soon came into collision with Pope Innocent IV on the question of the induction of foreigners into English benefices. He refused to institute the Pope's nephew, Frederick di Lavagna, to a canonry at Lincoln, and disregarded the Papal fulminations which he thus incurred. His writings, few of which have been published, are very voluminous.—Cf. F. S. Stevenson, *Robert Grosseteste, Bishop of Lincoln*.

Grosse′to, a province of Tuscany, Italy; area, 1735 sq. miles; pop. (1915), 155,774. Being mountainous and marshy, it is little adapted for cultivation. Its capital, Grosseto, on the Ombrone, is the seat of a bishop, and has a beautiful cathedral. Pop. (commune), 9600.

Grossula′ceæ, or **Grossulariaceæ**, a tribe of plants of the nat. ord. Saxifragaceæ, comprehending the gooseberry and currant of gardens, and consisting, in fact, of only one genus, Ribes; natives of most parts of the world except Africa and the tropics.

Grosswardein (grōs′vȧr-dīn), a town in Roumania, formerly a royal free city of Hungary, capital of the county Bihar, in a beautiful plain, on the Körös. It consists of the town proper, formerly fortified and surrounded by walls, and of extensive suburbs, is tolerably well built, and is a railway centre. The staple manufacture is earthenware. Pop. 48,000.

Grosvenor Gallery (grō′ve-nor), a building erected in 1877 by Sir Coutts Lindsay in New Bond Street, London, for annual exhibitions of pictures. In these exhibitions, which began on 1st of May, preference was generally given to certain schools of art, represented by such names as Burne Jones, Rossetti, &c., and in general to work appealing more to a peculiar æsthetic taste than to the popular mind; hence the allusion in *Patience*:—

> A greenery-yallery, Grosvenor Gallery,
> Foot-in-the-grave young man.

Grote, George, English historian and politician, was born in 1794, died in 1871. His grandfather, descended from German ancestors, was one of the original partners of the London banking-house of Prescott, Grote, & Co. Having been educated at Sevenoaks and at the Charterhouse, in 1810 he entered his father's banking establishment as a clerk. As early as 1823 he began to collect materials for his *History of Greece*. In 1832 he was elected a member of Parliament for the city of London, and his subsequent parliamentary career, until his retirement in 1841, was principally devoted to the advocacy of vote by ballot. He was also a leader of the ‘ Philosophic Radicals ’. In 1846 appeared the first two volumes of his *History of Greece*. The remaining ten volumes followed in rapid succession, the final volume being published in 1856. The work terminates with the death of Alexander the Great, and as a whole is a monument of erudition. It is, however, not strictly impartial, and some of it has been rendered obsolete by more recent discoveries, especially by the discovery of Aristotle's *Constitution of Athens*. In 1865 he published *Plato and the Other Companions of Sokrates*, and was engaged at the time of his death on an elaborate treatise on *Aristotle and the Peripatetics*. In the latter part of his life he was concerned in the management of University College, the London University, and the British Museum. He refused a peerage in 1869, and was buried in Westminster Abbey. The fifth edition of his *History of Greece* appeared in 1888.—Cf. Mrs. Grote, *Personal Life of George Grote*.

Grotesque, in art, a capricious variety of arabesque ornamentation, which, as a whole, has no type in nature, the parts of animals, plants, and other incongruous elements being combined together; used by the Romans in decorative painting and revived by the artists of the Renaissance.

Grotius, or **De Groot**, Hugo, a Dutch scholar, born at Delft 1583, died at Rostock in 1645. He entered the University of Leyden when only eleven, was a pupil of J. J. Scaliger, under whose supervision he edited Marcianus Capella and *The Phenomena* of Aratus. In his fifteenth year he graduated, and in the year after he accompanied the Dutch Ambassador to France. Having sided with the party of the Remonstrants, Grotius was condemned to perpetual imprisonment by the opposite and successful party, but he escaped. Louis XIII granted him a pension, subsequently withdrawn. After several vicissitudes he went to Stockholm, entered the service of Queen Christina, and was appointed Ambassador to France in 1635. His greatest work is *De Jure Belli et Pacis* (1625), on the fundamental principles of international law. He also wrote *Annales et Historiæ de Rebus Belgicis*, and *Annotations on the Old and New Testaments*.—Cf. C. Butler, *Life of Hugo Grotius*.

Grouchy (grö′shē), Emmanuel, Marquis de, a noted French general, born at Paris 1766, died in 1847. He entered the Royal Life Guards at the age of fourteen, saw much service, and highly distinguished himself. In the war with Prussia in 1806, and Russia (1807), and at Wagram, he acquired increased renown. In 1815 he defeated Blücher at Ligny. Having been ordered to follow the Prussian retreat, he was unable to aid Napoleon at Waterloo. He was banished under the second Restoration, and lived for a few years at Philadelphia. In 1821 he returned to France, where he died.

Ground, in painting, is used in several different senses. (1) The material on which the painting is carried out, such as plaster, wood, canvas, or paper. (2) The preparation applied to this material to facilitate application of the paint, often known as *priming*. (3) The first layer of colour given to (2). The Italian school preceding and during the time of Raphael employed white grounds, but afterwards, when canvas had superseded panels, the Italian and Spanish schools frequently adopted an oil ground of a dull-red colour. Velasquez is said to have used a black or dark-grey ground. The Dutch and Flemish masters used light grounds varying from white to grey, and their example has generally been followed by English painters and those of the modern European schools.

Ground-annual, in Scottish law, the rent paid for a piece of ground that is built upon, to one who holds the ground in feu. It may thus be a perpetual annuity. A vendor often prefers a ground-annual to a lump sum. It is similar to the English term *Ground-rent.*

Ground Dove, or Ground Pigeon, a name of various species of pigeons (family Peristeridæ), which resemble game-birds and fowls in living mainly on the ground, their feet being better suited for walking than perching. They include: American mourning doves (Zenaidinæ), white-winged doves (Melopelia), and others (species of Chamæpelia); the Old World turtle-doves (Turturinæ); the Cape dove (*Æna capensis*) and African ground dove (*Chalcopelia afra*); and the Australian bronze-wings (Phaps, Histriophaps, Geophaps, Ocyphaps, Lophophaps, and Chalcoptĕra).

Ground Ivy, *Glecōma hederăcĕa,* a common British plant of the ord. Labiātæ, with a creeping stem and purple flowers. Tea made from it is used by the poor for pectoral complaints. It was formerly employed to flavour ale.

Ground-nut, a term which denotes the seeds or pods of the *Arăchis hypogœa,* or the tubers of certain umbellifers (earth-nuts). The *Arăchis hypogœa* is a leguminous annual of diffuse habit, with hairy stem, and abruptly pinnate leaflets. The nut or pod is situated at the end of a stalk of some length, and is ripened underground, this stalk having the peculiarity after flowering of bending down and pushing the fruit into the earth. The plant is extensively cultivated in tropical countries. The nuts have a flavour similar to almonds, and yield an oil that may be used for olive-oil. See *Earth-nut.*

Ground-pine (*Ajūga Chamœpitys*), a herbaceous labiate plant, so called from its resinous smell. Also a name given to some lycopods or club-mosses.

Ground-rent, in English law, is the rent paid to a landowner by a person for the use of ground on which buildings are erected. The usual arrangement is for a specified time, generally ninety-nine years. On the expiry of this period the whole of the buildings become the property of the ground-landlord.

Groundsel (*Senecio vulgāris*), a European weed belonging to the nat. ord. Compositæ. The plant is emollient, has a slightly acid taste, but is rejected by almost every quadruped except the hog and goat; small birds, especially cage-birds, however, are very fond of the seeds.

Ground Squirrel, the name of North American squirrels of the genus Tamias, somewhat resembling the marmot. They differ from the common squirrel in possessing cheek-pouches, and in retreating into burrows. The name is also given to some African forms (species of Xerus).

Groups, Theory of. This branch of mathematics is a modern development which was started by E. Galois (1811–32). A group of operations has the property that if one operation of the group is applied to any one of an appropriate set of objects, it produces another of the set. A simple example of a group is that of the substitutions of three elements or letters a, b, c, taken in order. Denoting by S the operation of changing abc into bca, we may write $\mathrm{S} \,.\, abc = bca$. Hence $\mathrm{S}(\mathrm{S} \,.\, abc) = \mathrm{S}(bca) = cab$. This may be written $\mathrm{S}^2 \,.\, abc = cab$. Similarly $\mathrm{S}^3 \,.\, abc = abc$. The last result may be denoted by $\mathrm{S}^3 = 1$, which implies that the operation S applied three times in succession will reproduce the original object abc.

In this contracted notation, it is obvious that $\mathrm{S}^{3n+r} = \mathrm{S}^r$, where n and r are positive integers; and that any succession of such operations is equivalent to 1, S, or S^2. The inverse operation S^{-1} is defined by the identity $\mathrm{S}(\mathrm{S}^{-1}) = 1$, so that $\mathrm{S}^{-1} \,.\, abc = cab = \mathrm{S}^2 \,.\, abc$, or $\mathrm{S}^{-1} = \mathrm{S}^2$. It follows that an operation consisting of any combination of successively applied operations of the set 1, S, S^2 will be equivalent to one of these three. These three operations form a group of the third order, since the number of distinct operations in the group is 3. If the inverse of any operation in the group is not included in the group, it is not a group in the full sense of the term, and is called a semi-group.

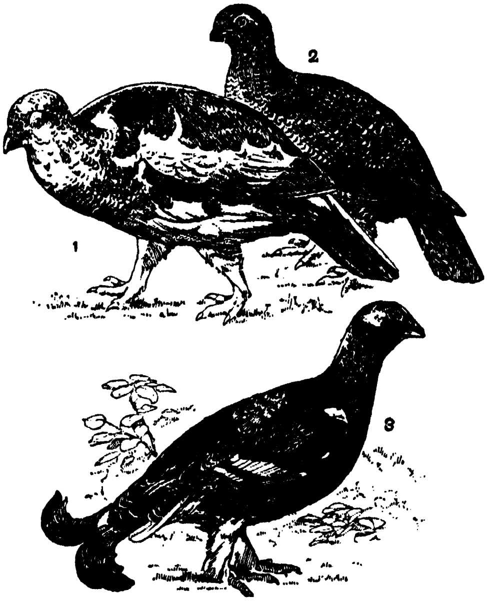
Let T, U, V be the operations which respectively change abc into acb, cba, and bac. Then $\mathrm{T}(\mathrm{T} \,.\, abc) = \mathrm{T} \,.\, acb = abc$. Therefore $\mathrm{T}^2 = 1$. Similarly $\mathrm{U}^2 = 1$, $\mathrm{V}^2 = 1$. Also $\mathrm{U}(\mathrm{V} \,.\, abc) = \mathrm{U}(bac) = cab = \mathrm{S}^2(abc)$, so that $\mathrm{UV} = \mathrm{S}^2$. Note that while $\mathrm{UV} = \mathrm{S}^2$, $\mathrm{VU} = \mathrm{S}$.

The operations 1, T, U, V, S, S^2 form a group of order 6. It includes one sub-group 1, S, S^2 of order 3, and three sub-groups 1, T; 1, U; and 1, V, each of order 2. This is one of the class of permutation-groups. Every group of finite order can be represented, generally in several ways, by a permutation-group.

A transformation of co-ordinates in geometry is an operation coming under the theory of groups. If, for example, rectangular axes in a plane are rotated through $360^\circ/n$, where n is integral, the operation S which denotes such a transformation is one of the group $1, \mathrm{S}, \mathrm{S}^2 \ldots \mathrm{S}^{n-1}$, a cyclic group of order n, which will have as many sub-groups as there are primes between 1 and n. If the rotation takes place through $k \times 360^\circ$, where k is incommensurable, the order of the group will be infinite.

A more general problem, considered by S. Lie, who founded and developed the theory of *continuous groups,* is that of changing every point of space into another point. A very special class of continuous groups is associated with the displacements of a rigid body in space. A more general class deals with Contact Transformations, which are such that a surface transforms into a surface.

The theory of groups has shed new light on many branches of mathematics, such as Theory of Equations, Invariants, Geometry, and Kinematics.—Bibliography: W. Burnside, *Theory of Groups of Finite Order*; H. Hilton, *Finite Groups*; Miller, Blichfeldt, and Dickson, *Theory and Applications of Finite Groups*; J. E. Campbell, *Theory of Continuous Groups.*



Grouse

1, Ptarmigan (*Lagōpus mutus*). 2, Red grouse (*Lagōpus scoticus*). 3, Black grouse or black cock (*Lyrurus tetrix*).

Grouse, the general name of the game-birds of the sub-family Tetraoninæ, whose distinguishing mark is a naked band, often of a red colour, in place of an eyebrow. They are wild, shy, and almost untamable. They live in families, in forests and barren regions, and feed on berries, buds, and leaves. They are polygamous, the male abandoning the female, and leaving to her the whole care of the progeny. The eggs number eight to fourteen. The largest species is the *capercailzie* or *wood grouse* (*Tetrao urogallus*). (See *Capercailzie.*) Other British species are the black grouse, the red grouse, commonly called simply the grouse, and the white grouse or ptarmigan. The black grouse (*Lyrurus tetrix*) is about the size of a common fowl. The male has the outer feathers of the tail curved outwards, so that the tail is lyre-shaped. It chiefly lives in high and wooded situations, feeding on various kinds of berries. The female is commonly called *grey hen,* and the male *black cock.* The grouse with hairy feet, which undergo seasonal change of plumage form the genus Lagōpus. Of these the *red grouse* (*Lagōpus scoticus*) is the most important. This bird, also called *moorfowl,* is the only bird peculiar to Britain, and is found in large numbers in the Highlands of Scotland, also in Wales, the north of England, Ireland, and the Scottish islands. It pairs in the spring; the female lays eight or ten eggs. As soon as the young have attained their full size they unite in flocks of forty or fifty, and are extremely shy and wild. This bird attracts large numbers of sportsmen every August to the Scottish moors to take part in the grand sporting campaign which follows ‘ the twelfth ’. The *ptarmigan* or *white grouse* (*Lagōpus mutus*) is ash-coloured in summer, but its hue changes to a pure white in winter. It is found in Scotland and in most northern regions, inhabiting the tops of mountains. Among North American grouse the most remarkable is the prairie-hen (*Tympanuchus americanus*), which inhabits open desert plains in particular districts of the Union. The male is furnished with wing-like appendages to his neck, covering two loose, orange sacs, capable of being inflated. Related species are the lesser prairie-hen (*T. pallidicinctus*) and the nearly extinct heath-hen (*T. cupido*), only found in the island of Martha's Vineyard. The pine-grouse (*Dendragapus obscurus, D. fuliginosus,* and *D. richardsoni*) are Rocky Mountain forms. To these may be added the cock of the plains (q.v.) or sage-cock (*Centrocercus urophasianus*), the prairie-chicken (*Pediœcetes phasianellus*), and the Canada grouse or spruce partridge (*Canachites canadensis*). See also *Hazel Grouse*; *Ruffed Grouse*; *Sand Grouse*; *Willow Grouse.* —Bibliography: F. O. Morris, *A History of British Birds*; J. G. Millais, *The Natural History of British Game Birds*; G. Malcolm and A. Maxwell, *Grouse and Grouse Moors.*

Grouse Disease, an epidemic causing, at certain seasons, great destruction to the grouse species in Britain. It is caused by various intestinal parasites, and also by microscopic forms (parasitic Protozoa) that infest the tissues.

Grove, Sir George, English writer, born 1820, died in 1900. He was educated as a civil engineer, in which capacity he was connected with the Britannia Bridge and other important works. He was long secretary to the Crystal Palace Company, and did much for the popularizing of classical music in connection with its concerts. For some years he edited *Macmillan's Magazine*, and he was editor of, and a contributor to, the great *Dictionary of Music*, published between 1878 and 1889. He was also an extensive contributor to *Smith's Dictionary of the Bible*. He was knighted in 1883. A new edition of Grove's *Dictionary of Music*, by Fuller-Maitland, appeared between 1904 and 1910.

Groves. Among various ancient nations groves have been, probably on account of the mental impressions their stillness is calculated to make, considered as suitable localities for religious rites. The Hebrew word *asherah*, translated 'grove' in the Authorized Version of the Old Testament, seems to signify some idol or idolatrous symbol. In the religion of the ancient Greeks and Romans groves played an important part. See *Dodona*.

Growler (*Micropterus nigricans*), a fresh-water fish of North America, affording good food, called also black-bass. It emits a growling sound. See *Drum-fish*.

Grub Street, a London street near Moorfields, famous at one time for its literary hacks, and described by Dr. Johnson in his *Dictionary* as follows: "Originally the name of a street near Moorfields, much inhabited by writers of small histories, dictionaries, and temporary poems, whence any mean production is called Grub Street". The street, called Milton Street since 1830 (whether in honour of the poet or of one Milton, a builder, it is doubtful), was inhabited by less fortunate writers, and hence the jest of the more favoured authors. The expression Grub Street was used in a contemptuous and disparaging way by Andrew Marvell, Pope, Swift, Goldsmith, and Carlyle.

Grugru, the larva of the *Calandra palmarum*, or palm weevil, found in the tropical parts of America. It is of the length and thickness of a man's thumb, burrows in cabbage-palms and canes, and is, when cooked, considered a great delicacy.

Grünberg (grün′ber*h*), a town in Silesia, surrounded by vineyards, which produce large quantities of wine. Pop. 23,000.

Grundy, Sydney, English dramatist, born in Manchester 23rd March, 1848, died 4th July, 1914. Educated at Owens College, he was called to the Bar in 1869, and practised till 1876. He then began to write for the stage, and became known as a successful playwright. Among his numerous plays are: *A Fool's Paradise* (1890), *A White Lie* (1893), *Sowing the Wind* (1893), *The New Woman* (1894), *The Degenerates* (1899), *The Musketeers* (1899), *Business is Business* (1905), *A Fearful Joy* (1908), &c. Many of his plays were clever adaptations from the French, such as *The Bells of Haslemere*, and *A Pair of Spectacles*.

Gruyères (gru̇-yār), a village, Switzerland, canton and 16 miles south of Fribourg, on a hill crowned by a fine old feudal castle. It gives its name to the well-known cheese made from a mixture of goats' and ewes' milk, which is firm and dry, and contains numerous holes. Pop. 1400.

Grysbok (grīs′bok, 'grey buck'), *Raphiceros melanōtis*, a species of antelope found in Southern Africa. It attains about 3 feet in length, is 1½ feet high at the shoulder, and its colour is reddish-grey. It is hunted for the sake of its flesh.

Guacharo (gwȧ-chä′rō), *Steatornis caripensis*, a bird related to the goatsuckers, but belonging to a special family (Steatornithidæ). It is of nocturnal habits, and found in great numbers in certain caves of Venezuela, Guiana, Trinidad, Colombia, Ecuador, and Peru. It is about the size of a common fowl, with a curved and toothed bill, wings long and pointed. Its food is principally fruits, upon which it grows so fat that the Indians destroy great numbers for the sake of their oil or clarified fat, which is transparent, inodorous, and keeps long without becoming rancid. It is also called *Oil-bird*.

Guadalajara (gwȧ-*d*ȧ-lȧ-hä′rȧ), a town, Spain, capital of the province of same name, on the Henares, 44 miles north-east of Madrid. It is substantially built, with manufactures of woollens, soap, and earthenware. Pop. 12,176.—The province—area, 4676 sq. miles—is mountainous, or forms part of an elevated plateau. Pop. (1919), 214,288.

Guadalajara, a city of Mexico, capital of the state of Jalisco, in the fruitful valley of Atemajac, on the Rio de Santiago; a large and handsome city, with a fine cathedral (being an archbishop's see), and other good buildings; a university and a mint. Various manufactures are carried on, as those of silversmiths' and goldsmiths' wares, paper, leather, hats, pottery, and cloth. Pop. 119,468.

Guadalquivir (gwȧ-*d*ȧl-kē-vēr′; Ar. *Wad-el-Kebir*, great river), a river, Spain, which rises in the frontiers of Murcia, traverses Andalusia from north-east to south-west, passing the towns of Cordova and Seville, and, thereafter flowing south-south-west, falls into the Atlantic. Its course is 250 miles, of which 70 miles are navigable. It abounds in fish.

Guadeloupe (gwä-dė-lōp), a French colony, one of the French West Indies, Lesser Antilles, composed of two portions, separated by a narrow arm of the sea called Rivière Salée (salt river). The western and larger portion is Basse-terre, or Guadeloupe Proper, 27 miles long by about 15 miles broad. The eastern portion, called Grande-terre, is nearly 30 miles long by 10 to 12 miles broad. Guadeloupe Proper is of volcanic formation, the culminating point being La Soufrière, 5018 feet. Grande-terre, on the other hand, is generally flat, and of coral formation. Guadeloupe is watered by a number of small streams which become dry in summer. Grande-terre has only a few springs of brackish, undrinkable water. The climate is hot and unhealthy, with a remarkably humid atmosphere, and hurricanes are frequent and destructive. The soil is fertile. The chief exports (amounting annually to about 50,000,000 francs) are sugar, coffee, dye and cabinet woods, pepper, manioc, and tobacco. The chief town is Basse-terre. Discovered by Columbus in 1493, the island was alternately in the possession of France and Great Britain, transferred to Sweden in 1813, and restored to France in 1814. Area of Guadeloupe, 722 sq. miles; of dependencies, 688 sq. miles. Pop. 212,430.

Guadiana (gwȧ-*di*-ä′nȧ), a river of Spain, which rises in New Castile, flows first north-west, then south-west into Estremadura, and on reaching Badajoz begins to form part of the boundary between Spain and Portugal. Entering that kingdom, it finally falls into the Atlantic after a course of 400 miles, of which only 35 miles are navigable.

Guadix (gwȧ-*dēh′*), a town of Southern Spain, Andalusia, in the province and 31 miles E.N.E. of Granada. It is said to be the first bishop's see erected in Spain, and has a handsome cathedral, and a finely situated old castle, almost in ruins. Pop. 13,820.

Guad′uas, a town, Republic of Colombia, remarkable as being one of the most elevated places on the globe, being 3300 feet above the sea-level. Pop. 9000.

Guaiacum (gwī′a-kum), a genus of plants, belonging to the nat. ord. Zygophyllaceæ, and containing four or five arborescent species, natives of the West Indies and the tropical parts of America. *G. officināle* has wood that is exceedingly hard, of a pale-yellow colour near the exterior, and blackish-brown at the heart, heavier than water, and well known under the name of *lignum-vitæ*. Among other uses it is employed in the construction of ornamental articles of furniture, being susceptible of a fine polish. This tree yields the resin known as guaiacum, which either flows spontaneously from the tree, or from incisions or perforations in the stem, or is got by extraction by means of spirit from the wood. It is greenish-brown, has a balsamic odour, its taste is somewhat bitter and pungent, and it dissolves freely in spirit, but is insoluble in water. Its chief use is in medicine, the resin (as well as a decoction of the bark and wood) acting as a stimulant in chronic rheumatism, and being used also in gout, scrofula, syphilis, and other diseases.

Gu′an, a gallinaceous bird of the family Cracidæ or Curassows, genera Penelŏpē, Penelopina, Ortālis, Pipile, Aburria, and Chamæpetes. The sides of the head and front of the throat are naked and wattled, the wattles capable of inflation. The name Guan is more particularly applied to the *Penelŏpē cristāta*, the largest bird of the genus, measuring about 30 inches. The guans perch on trees, descending in search of grain and fruits, and range from Central America to the Argentine. They have been frequently carried to Europe, and with a little care would make a valuable addition to the farmer's stock of poultry in Britain.

Guanaco (gwȧn-ä′kō), or **Huanaco**, *Llama huanacos*, a South American ruminant, of which the domesticated races are the llama and alpaca. It abounds most in Chile and Patagonia, attains a height of nearly 4 feet at the shoulders, and is extremely swift and sure-footed. When domesticated, its flesh, wool, and milk are prized by the natives. In domestication it is of uncertain temper, and ejects saliva on those who annoy it.

Guanajuato (gwȧ-nȧ-*h*wä′tō), a city of Mexico, capital of the state of the same name, 160 miles north-west of Mexico, is situated in a narrow defile, hemmed in by mountains, at the height of 6800 feet above the sea, with steep irregular streets but well-built houses. Pop. 35,682.—The state is situated in the centre of Mexico; area, 10,950 sq. miles; pop. (1912), 1,085,681. Its mines, once the richest in the world, still yield a large amount of gold and silver. The surface is traversed by the cordillera of Anahuac, 9711 feet in height.

Guanches (gụ-ȧn′chez), or **Guanchos**, the aborigines of the Canary Islands, long ago extinct as a separate nation, although Guanche blood probably flows in the veins of many of the present inhabitants. They possessed high moral and physical qualities. They practised the embalming of the dead. The few words of their language which remain seem cognate to the Berber tongue. Their culture reveals unmistakable evidence of Egyptian and Mediterranean inspiration.

Guan′o (Peru. *huanu*, dung), a valuable manure, consisting of the partially decomposed and dry excrement of fish-eating sea-birds, which has in some places accumulated in great masses. The name has been also extended to accumulations of a similar kind from land-birds, and even from bats in caverns. Owing to the fact that rain washes such deposits away, great accumulations of guano exist principally in hot and dry tropical regions. The most important of all were the deposits on the Chincha Islands off the coast of Peru, which yielded a considerable revenue to the country, but are now quite exhausted. From 1853 to 1872, when the guano industry was at its height, about 8,000,000 tons were got from these islands. The guano which was found there was from 60 to 80 or 100 feet in thickness, and was entirely due to the droppings, accumulated for many ages, of the innumerable sea-birds which make these islands their resting-place and breeding-ground. Other deposits of less extent have from time to time been found, and Peru still remains the chief source of supply, its deposits being now, however, worked under the Peruvian Government. Guano varies extremely in composition, but it may be roughly divided into nitrogenous and phosphatic. The first of these contains about 21 per cent of ammonia. This is the case with the Peruvian variety, which contains almost all the inorganic matter required by a plant, and that in a highly available form, so that it is looked upon as one of the best of all fertilizing agents for different crops. Its use as a manure was known to the native Peruvians centuries ago, but no attention was paid to the accounts by modern travellers of its wonderful efficacy until A. von Humboldt brought some to Europe and had it analysed. It began to be brought to Europe about 1846. It is used raw or in its natural state, but most of the phosphatic guanos (some of which hardly deserve the name of guano) require to be dissolved by sulphuric acid before using. There are very rich deposits of phosphatic guano on Christmas Island, south of Java. There are also manures known as *fish guano*, prepared from fish or fish refuse, *flesh guano*, *blood guano*, &c. Large quantities of fish guano are made in the United States from the menhaden, the oil being first extracted.—Cf. J. C. Nesbit, *On Agricultural Chemistry and the Nature and Properties of Peruvian Guano.*

Guapore (gwȧ-pō′rā), or **Itenez**, a river of South America, which rises in the Brazilian province of Matto Grosso, and, after a varied course of about 500 miles, unites with the Mamore in forming the Madeira.

Guarana Bread (gwȧ-rä′nȧ), the seeds of the *Paullinia sorbilis*, ord. Sapindaceæ, a South American tree, pounded and made into cakes. It is extensively used in South America as a stimulant and restorative, and as a material for making a refreshing beverage. The active principle of guarana is said to be identical with theine or caffeine; and no known substance yields it so abundantly, the amount being 5·07 per cent, as against good black tea, which yields from 2 to 4 per cent, and coffee about 1·5 per cent.

Guarantee′ (O.Fr. *garantie*, warrantry), in law, an undertaking by which a person binds himself to answer for the failure of another. In England no person is liable on any special promise to answer for the debt, default, or miscarriage of another person, unless a written agreement, or some memorandum in writing for such purpose, shall be signed by the promiser or some other party lawfully authorized by him. It is a general rule that the surety shall not be bound beyond the express words of the engagement.

Guardian, in law, the custodier of persons incapable of directing themselves, and especially of infants, that is, persons under twenty-one years of age. In England they may be said to be of five kinds: first, testamentary, or appointed by will; second, customary, by local usage; third, *ad litem*, or appointed by a court in order to conduct legal proceedings; fourth, by appointment of chancery; fifth, in tort, or by intrusion. Guardianship lasts in the case of the young until they have attained the age of twenty-one. An Act passed in 1885 provides that, if the father dies without appointing a guardian, the mother becomes sole guardian, and even if a guardian has been appointed the mother is entitled to become a guardian conjointly.

Guardian Angel, the angelic guardian who, by some, is supposed to watch over every human being with a view to preserving him or her from moral evil. The notion is based on *Gen.* xlviii, 16; *Matt.* xviii, 10; and *Heb.* i, 14.

Guardians of the Poor, in England, persons elected to manage the affairs of the poor. The guardians have the management of the workhouse, and the maintenance, clothing, and relief of the poor. Under the provisions of the Parish Councils Act of 1894, the district councillors now act as guardians in rural parishes.

Guards, Brigade of, consists of the five regiments of foot guards. These are, in order of precedence, the Grenadier Guards of three battalions, the Coldstream Guards of three, the Scots Guards of two, and the Irish and Welsh Guards of one battalion each.

The Grenadier Guards date their official origin to 23rd Nov., 1660, when Charles II, on his return to England at the Restoration, issued a commission to Colonel John Russell to raise a regiment of foot guards under the name of the King's Regiment of Foot Guards. Four years previously, during his period of exile, Charles had in his service, while in Flanders, a regiment which was known as the Royal Regiment of Guards. After the Restoration, this regiment continued to be stationed on the Continent at Dunkirk till, on the sale of that place in 1665, it was brought to England and incorporated with the later-raised King's Regiment of Foot Guards. The Grenadier Guards wear a white plume in their bearskins and have a red cap-band. They have the buttons of their tunics evenly spaced in the ordinary way.

The Coldstream Guards trace their official connection with the royal army of England to 14th Feb., 1661, though the actual origin of the regiment goes back to 1649, in which year a regiment was formed for General Monck by taking five companies from each of two existing new model regiments. On 1st Jan., 1660, Monck, who was then stationed in Coldstream with his regiment, and who was dissatisfied with the state of affairs in London, set out on his march southwards. On arrival in London in February he took charge of affairs, and on the return of Charles II Monck offered his services, which were accepted. An order had been given that all the Republican regiments were to be disbanded; but, in order to retain Monck's regiment in the royal service, its formal disbandment was left to the last, and even then was a mere matter of form, the men, drawn up on parade, simply laying down their arms as Republican soldiers and taking them up again as soldiers of the king. The Coldstreams wear a red plume and a white cap-band, and have the buttons of their tunics spaced in twos.

The Scots Guards were first raised in Scotland by Charles I in 1642 as Argyle's Regiment, becoming under Charles II the regiment of Scottish Foot Guards (on the Scottish establishment). In 1686 the regiment was brought on to the English establishment, one battalion serving at Windsor in 1695. In 1831 the regiment was known as the Scots Fusilier Guards, and received its present designation in 1877. The Scots Guards wear no plume and have a checked cap-band. They wear their buttons in threes.

The Irish Guards were formed in 1900 to commemorate the bravery of Irish regiments in the South African War. They wear a blue plume and green cap-band. Their tunic buttons are spread in two groups of four.

The Welsh Guards were raised by royal warrant on 26th Feb., 1915, a nucleus of some 300 men being found by other guards regiments.

All guards regiments have the distinction of company colours bearing separate royal badges, which are carried in turn on the regimental colours.

Guard-ship, a vessel of war appointed to superintend the marine affairs in a harbour, and to visit every night the ships of war which are not commissioned; she also acts as a depot for seamen raised in the port until appropriated to other vessels.

Guarini (gwȧ-rē′nē), Giovanni Battista, Italian poet, was born at Ferrara 1537, and died at Venice in 1612. After having studied at Ferrara, Pisa, and Padua, and lectured in his native city on Aristotle, he entered the service of Duke Alphonso II of Ferrara, who sent him on various important missions. Having lost the favour of the prince, he retired into private life, but was recalled in 1585 to the office of Secretary of State. Two years after he retired a second time. In 1597 he entered the service of Ferdinand I, Grand-Duke of Tuscany, which he soon quitted. His propensity to litigiousness necessitated his residence at Venice, Padua, and Rome. In 1605 he went as an ambassador of his native city to the court of Rome, to congratulate Paul V on his elevation. Guarini is one of the most famous authors of Italy, as is especially shown in his *Il Pastor Fido* (Faithful Shepherd), a pastoral drama. The work has gone through numerous editions, been translated into various European languages, and influenced Calderon and Shelley.

Guarnieri (gwȧr-nā′rē), the name of an Italian family belonging to Cremona, distinguished for its skill in violin-making. The most celebrated of the family was Giuseppe, whose best instruments belong to the years 1710–45.

Guastalla (gwȧs-tȧl′lȧ), a small town of North Italy, near the Po, which in the sixteenth century gave its name to the dominion of the Gonzagas, Dukes of Mantua. Pop. 11,880.

Guatemala (gwȧ-te-mä′lȧ), a republic of Central America; area estimated at 48,290 sq. miles; pop. (1915), 2,003,579. It is in general exceedingly picturesque, and distinguished by a luxuriant and varied vegetation. It is wholly mountainous or elevated, the main chain of the Central American system traversing it south-east to north-west, and sending off numerous branches. Along the main chain are a considerable number of volcanoes, several of which are said to be active—as Fuego and Agua (14,890 feet high), which sends forth torrents of water. The state is well watered by numerous streams, none of much importance. There are several lakes, the most important being Dulce, through which a great part of the foreign trade of the state is carried on; Amatitlan, Atitlan, and Peten. On the tableland, of which a considerable portion of the state is formed, the climate is mild; but in more elevated situations the cold is intense. There is much valuable timber. The soil generally is of great fertility, producing, according to altitude and soil, maize, wheat, rice, coffee, cotton, tobacco, sugar, cochineal, cacao, indigo, vegetables, and tropical fruits in great variety. Fibre plants are numerous, including ramie, henequen, and others. The most important product is coffee, and the other chief exports are skins, caoutchouc, cochineal, and wool. The trade is chiefly carried on with Britain, the United States, Germany, and France. The exports in 1919 were about £4,483,827 in value (nine-tenths being coffee). In the *altos* or mountainous parts of the north-west considerable flocks of sheep are raised, the wool of which is manufactured into coarse fabrics. But the manufacturing industries are very insignificant, and trade is hindered by the want of roads and railways, the total length of the latter being only about 150 miles. Only about a third of the population are of European or mixed descent, the rest being Indians of the Aztec, Toltec, or Maya races, mostly speaking their own native tongue. Numbers of the Indians are still quite uncivilized. Great attention is now being paid to education, the children, even Indians, in small and remote villages being compelled to attend school. The University of Guatemala (Universidad Estrada Cabrera) was opened on 15th Sept., 1918. The chief port is San José on the Pacific; Champerico on the Pacific, and Livingston in the Bay of Honduras are the other ports. The legislative power is vested in a National Assembly, elected for four years by universal suffrage, and a Council of State of thirteen members. The executive is vested in a President, elected for six years. The revenue in 1920 was 127,249,490 dollars, the expenditure 101,028,476 dollars; the foreign debt in 1921 was £2,259,583.—*New Guatemala*, or *Santiago de Guatemala*, the capital, was situated about 5000 feet above the sea, and 80 miles distant from the Pacific. Regularly built, with a fine cathedral, archbishop's palace, a university, and manufactures of textiles, cigars, pottery, saddlery, and embroidery, the city was completely destroyed by an earthquake on 3rd and 4th Jan., 1917. Pop. 90,000.—*Old Guatemala*, the former capital, is 10 miles south-west of New Guatemala. It was founded by the Spanish in 1542, and continued to be the capital till 1774, when it was destroyed by a volcanic outbreak. It has been rebuilt, however, and the population is now about 20,000.—BIBLIOGRAPHY: N. O. Winter, *Guatemala and her People of To-day*; D. Fife, *Guatemala and the States of Central America.*

White Guava. Flowers, Foliage, and Fruit

Guava (gwä′va), the popular name for plants of the tropical genus Psidium of the nat. ord. Myrtaceæ. *P. Guaiava* (the guava tree) is a small tree, with square branches, egg-shaped leaves, and large white axillary flowers, which are succeeded by fleshy berries, which are either apple or pear shaped in the two principal varieties. The pulp is of an agreeable flavour, and of this fruit is made a delicious and well-known jelly. There is also a product called guava cheese.

Guayaquil (gwī-ȧ-kēl′), a city and seaport in Ecuador, on the Guayaquil, here about 2 miles wide, some 40 miles above its mouth in the Gulf of Guayaquil. Behind the town is an extensive marsh, which renders it unhealthy, causing fever. It is the seat of a bishop, and has a cathedral and a university. It is the chief port of Ecuador, and one of the best on the west coast of South America. Its principal exports are cacao (to the value sometimes of £1,000,000), coffee, and ivory-nuts. Pop. estimated at 80,000.

Gubbio (gṳb′i-ō; ancient **Iguvium**), a town in Italy, in the province of Umbria. It is a bishop's see, and has manufactures of silk and woollen stuffs. Here were discovered the Eugubine Tables (q.v.) in 1444. Pop. 27,400.

Guben, a town in Prussia, province of Brandenburg. Brewing, dyeing, and tanning are carried on, and there are manufactures of woollen and linen cloth, and tobacco. Pop. 38,593.

Gubernatis, Count Angelo de, Italian Orientalist, man of letters, and critic, born at Turin 7th April, 1840, died 26th Feb., 1913. At the age of seventeen he contributed to several periodicals and wrote plays. In 1862 he went to Berlin, where he studied Sanskrit, and in 1863 he was appointed professor of Sanskrit at Florence. Drawn by Bakunin into the Republican party, he resigned his post and married a cousin of the Russian revolutionary. In 1867 he was reelected to the professorship, and in 1891 he was called to the University of Rome. Gubernatis founded and carried on many periodicals, and through his efforts the Indian Museum at Florence was established. His numerous works include: *La Morte di Catone*, a drama (1863); *Il re Nala*, an Indian play (1869); *Gabriele*, a novel (1866). His fame, however, as a scholar he owes to the following works: *Zoological Mythology* (London, 1872), *Mitologia Vedica* (1874), *Mythologie des Plantes* (1878–80), and *Storia Universale della Letteratura* (1882–5). He also wrote: *Dictionnaire international des écrivains du jour* (1888 - 91), *Alessandro Manzoni* (1878), *La Donna Italiana* (1891), and *La Hongrie politique et sociale* (1885).

Gudgeon (*Gobio fluviatilis*), a freshwater fish, belonging to the carp family (Cyprinidæ). It has short dorsal and anal fins, without spines; on each side of the mouth there is a small barbel; neither jaw is furnished with teeth, but, at the entrance of the throat, there are two triangular bones that perform the office of grinders. These fish are taken in gentle streams, and measure only about 6 inches. They are common in England, Wales, and Ireland, and range through Europe to Siberia and Mongolia.

Gudrun (gṳd′rṳn), a celebrated German popular epic belonging to the end of the twelfth century, receiving its name from its heroine, Gudrun, daughter of King Hettel of Hegelingen. Hettel is defeated by Hartmut, son of King Louis of Normandy, who carries Gudrun off, and, on her steadfast refusal to marry him, has her subjected to various kinds of ill-treatment, and in particular lets his mother keep her for years engaged in the lowest kinds of drudgery. At last she is released and avenged by her brother and her betrothed, King Herwig of Seeland. The poem also deals with the fortunes of Gudrun's father and mother, grandfather and grandmother, and the scene is partly in North Germany, Denmark, and Friesland, partly in Ireland and Normandy.—BIBLIOGRAPHY: F. E. Sandbach, *The Nibelungenlied and Gudrun in England and America*; A. Fécamp, *Le Poème de Gudrun: ses origines, sa formation et son histoire.*

Guebres, or **Guebers** (gē′bėrz), a name given to the fire-worshippers of Persia, represented in India by the Parsees. The original Guebres or followers of Zoroaster are now represented almost solely by those who inhabit the cities of Yezd and Kirman and the adjoining villages. At present they number only about 8000 or 10,000. As supreme deity they recognize Ahuramazda, or Ormuzd, the principle of light and source of all that is good; and his opposite and antagonist, the evil principle, the latter called Ahriman. They believe in the existence of heaven and hell, between which stretches the Bridge of the Gatherer or Judge; over this none but the righteous may pass. Among their leading practices may be mentioned their refusal to contract marriages with those of other creeds; their objection to eating beef or pork, or to partake of anything cooked by one of another religion. They regard Ahuramazda as the source of light, and in their temples they feed the altars with perpetual fire, and hence their name fire-worshippers; but they do not revere it except as a symbol of the deity. When, in A.D. 651, Yezdegird, the last of the Sassanides, was defeated by the Caliph Omar, the majority of the Persians embraced Islam. Those who continued Zoroastrians received the name of Guebres or infidels, and were subjected to persecutions so severe that the majority emigrated to India, where they became known as Parsees. —Cf. E. B. Tylor, *Primitive Culture.*

Guelder Rose, or **Gueldres Rose**, a name given to the cultivated variety of the *Viburnum Opulus*, or water elder, of the ord. Caprifoliaceæ. On account of the shape and colour of its flowers it is sometimes called the Snowball Tree. Its fruit is of a pretty red colour.

Guelfs, or **Guelphs**, the name of a distinguished princely family which originated in Germany, but was also at one time connected with Italy, and which still flourishes in the two lines of the House of Brunswick, the royal (to which the four Georges and Victoria belonged) and the ducal. The first who bore the name is said to have been Welf, the son of Isenbrand, whose grandfather was a vassal of Charlemagne. See *Brunswick, Family of.*

Guelfs (or **Guelphs**) **and Ghibellines**, the names of two great Italian political parties in the thirteenth and fourteenth centuries. The names are derived from the Italian *Guelfi* and *Ghibellini*, which are corrupted from the German *Welfen* and *Waiblingen.* These latter words came to be used as party designations in Germany in the war between Henry the Proud and Conrad of Hohenstaufen, to whom belonged the estate of Waiblingen in Würtemberg. About the year 1200 the designations Guelf and Ghibelline came to be employed to denote respectively the Italian patriotic and Papal party, and the party which supported the domination of the German emperors in Italy. After the fall of the Hohenstaufen the Ghibellines became the partisans of aristocracy, and the Guelfs the partisans of democracy and liberty; but the designations ultimately denoted more communal and family feuds, and Dante, originally a Guelf, but subsequently a Ghibelline, asserted that the two parties were the cause of all the miseries of Italy. The contest continued with bitterness for almost 300 years. Bologna, Florence, and Milan were Guelf, whilst Arezzo, Pisa, and Verona were Ghibelline. The poet Petrarch was a Guelf. Corresponding parties appeared in Italy under many different names, as the *bianchi* and *neri* (white and black) in Florence. — Cf. J. A. Symonds, *The Renaissance in Italy.*

Guelph, a city of Canada, province of Ontario, in a rich farming district, 48½ miles w. of Toronto, with manufactures of machinery, agricultural implements, and pianos. It is the seat of the Ontario Agricultural College. Pop. 15,175.

Guenevere, or **Guinevere** (Guanhumara; W. *Gwenhwyfar*), daughter of King Leodograunce of Camelyard, and wife of King Arthur. She is a famous figure in the Arthurian romances, is supposed to have been the most beautiful of women, " surpassing in beauty all the women of the island ", and to have fallen in love with Lancelot of the Lake, one of the Knights of the Round Table. In Geoffrey of Monmouth's *History of Britain* she is a Roman lady of noble birth, and married Modred, King Arthur's nephew, during the king's absence. Arthur defeated Modred, and Guenevere fled from York to a nunnery. According to Layamon, she drowned herself. The story of Guenevere has also been treated by Malory, and by Tennyson in the *Idylls of the King*.—Cf. Professor Rhys, *Studies on the Arthurian Legend.*

Guereza, or **Guerza** (ger'e-za, ger'za; Colŏbus), the popular name of about ten species of African monkeys, remarkable for their beauty, and with a much reduced thumb. Short, glossy, jet-black fur covers their limbs, back, and head, while a long fringe of silky white hair depends from the flanks. They are arboreal in habit.

Guereza (*Colŏbus guereza*)

Guericke (ger'ik-e), Otto von, German physicist, born at Magdeburg (of which he became burgomaster or mayor) 1602, died at Hamburg 1686. About 1650 he invented the air-pump (q.v.), with which he made public experiments at the Diet at Ratisbon, before the Emperor Ferdinand III. His most important observations, collected by himself, appeared at Amsterdam in folio (in 1672) under the title *De Vacuo Spatio.*

Guérin (gā-raŋ), Pierre Narcisse, Baron, French historical painter, born at Paris 1774, died at Rome 1833. He achieved great success with classical subjects such as *Death of Cato of Utica, Return of Marcus Sextus, Phœdra and Hippolytus, Andromache, Clytemnestra.*

Guernsey (gėrn'zi), the second largest and most westerly of the Channel Islands, lying off the north coast of France, 46 miles from Cherbourg, and about 68 miles from Start Point in Devonshire. It is of a triangular form, about 9 miles long, and 3 to 4 miles broad. The northern part is level, the southern more elevated, coast lofty and abrupt, the island being almost entirely of granite formation. The climate is extremely healthy; snow is rare, and frosts light and of short continuance. The soil is fertile. The breeding of cattle and the dairy are the principal objects of attention; and the butter made is highly esteemed. Horticulture and floriculture also receive much attention, and fruit, especially figs and grapes (the latter grown under glass), is very abundant. The grape-houses are further utilized for the raising of early vegetables and tomatoes, which are sent to the London market. The principal exports are cattle (the dairy cows being renowned), fruits, vegetables in the early spring, and granite for paving. The dialect of the island is the pure Norman of some centuries ago; but a knowledge of English is general. The principal place of education is Elizabeth College, at St. Peter's Port, the capital, and only town in the island. Steamers ply regularly between Guernsey and London, Southampton, Plymouth, and Weymouth. The island is under a Lieutenant-Governor, who represents the sovereign in the Assembly of the States, a kind of local parliament. It is strongly fortified, and has a well-organized militia. Victor Hugo lived here in exile for nearly twenty years. Pop. 40,120.

Guernsey Lily (*Nerīnē Sarniensis*), a beautiful plant, with purple-red flowers, native of South Africa, family Amaryllidaceæ, so called from some of its bulbs being cast up in Guernsey from a wrecked ship and there taking root. There are several other species also called Guernsey lilies.

Guerrero (ger-rā'rō), a state of Mexico; area, 25,279 sq. miles. Its surface is finely diversified by mountain and valley, and partly covered by native forests; and it is rich in minerals, including gold, silver, copper, and iron. The principal port is Acapulco. Pop. (1910), 605,437, mostly Indians.

Guerrillas (ge-ril'az, in Spanish ge-ril'-yȧs), a name first given in Spain to light, irregular troops, consisting chiefly of peasants, who fought against the invading French in the early part of the last century. The name has now become quite a general term for such irregular troops, and has travelled far beyond Spain.

Guesde, Jules Basile, French Socialist leader, born in Paris 11th Nov., 1845. A journalist by profession, he founded in 1870 a paper, *Les Droits de l'homme*, in which he defended the Commune, and was imprisoned and exiled like so many other Communards. He lived for some time in Germany, where he became an adherent of Karl

Marx and an admirer of the Social Democratic party. Guesde was always an opponent of opportunism, and maintained that no Socialist should take office in a capitalist or bourgeois Cabinet. Thanks to his efforts the United Socialist party in France was created, in consequence of which such Socialists as Millerand, Briand, and Viviani left the ranks of socialism. In spite, however, of his stern, uncompromising Marxist tendencies, Guesde did not hesitate, when the European War broke out, to enter Viviani's Cabinet in 1914 as Minister without portfolio. He denounced Germany as the enemy of peace, and the German Socialists as traitors to the idea of socialism.—Cf. S. P. Orth, *Socialism and Democracy in Europe.*

Gueux (*geu*; Fr. ‘ beggars ’), a name given in derision to the allied nobles and other malcontents in the Netherlands who resisted the despotism of Philip II in 1566–7. The Count of Berlaymont having termed the malcontents *Gueux*, they adopted the name, and a suitable badge called the ‘ beggar's denier ’. They were totally dispersed in 1567. A branch of the Gueux, ‘ the beggars of the sea ’, under the leadership of Count de la Marck, captured Brill in 1572, and initiated the great struggle for independence which resulted in the freedom of the Netherlands in 1648.

Guevara y Dueñas (gā-vä′rȧ ē dụ-en′yȧs), Luis Velez de, a Spanish dramatic poet, born in 1570, died 1644. His literary fame rests chiefly on his *Diablo Cojuelo* (Lame Devil), which suggested the famous *Diable Boiteux* of Le Sage.

Guglielmi (gụl-yel′mē), Pietro, Italian composer, born 1727, died 1804. He composed comic and heroic operas for the Italian theatre, visited Vienna, Madrid, and London, and afterwards returned to Naples, where he became the rival of Paesiello. In 1793 Pius VI named him chapel-master of St. Peter's. He left more than 200 pieces, remarkable for their simple and beautiful airs, their rich harmony, and their spirit and originality.

Guiana (gi-an′a), **British,** a colony in the north of South America, about 560 miles long, and about 200 miles broad, having on the E. Dutch Guiana, W. Venezuela and Brazil, N. and N.E. the Atlantic, and S. Brazil; area, 89,480 sq. miles. It is divided into three settlements—Berbice, Demerara, and Essequibo. The coast tract forms a dreary belt, 10 to 40 miles broad, of mud-banks and shallows, and when drained the surface sinks 1 foot below the sea-level, hence strict attention must be paid to dams and sluices. This alluvial deposit is succeeded by a range of low hills not exceeding 200 feet in height. The interior is traversed in various directions by chains of hills or mountains. On the western boundary is the singular flat-topped and almost inaccessible mountain Roraima, rising to a height of 8600 feet. The other principal ranges are the Sierra Imataca, in the north part of the country; the Cannucu or Conocou, and the Sierra Acarai—the last occupying the extreme S.E. corner of the territory, forming its boundary in this direction. They are densely wooded, but do not reach a greater elevation than 4000 feet. The geological composition of the mountains of British Guiana is various. Some of them consist of granite, gneiss, and trap rocks, and their different modifications; others are of sandstone; and others again appear to be of white quartz. Gold occurs in various places, and mining commenced in 1884, the output from 1884 to 1918 being valued at more than £9,000,000. There are also deposits of manganese ore and mica, and huge deposits of bauxite, which were geologically examined in 1919. Rock crystals and red agate are met with; and very white clay is found in the Essequibo. The extensive flats along the shore are composed of alluvial soil and clays, resting upon granite. The chief rivers are the Essequibo, Demerara, Berbice, and Corentyn. The climate, though moist and warm, is not on the whole unhealthy. Cultivation is confined to the coast region; the soil is very fertile, and much of it well adapted for the sugar-cane, the cultivation of which is mostly carried on by Indian and Chinese coolies. Guiana also produces coffee, tobacco, and indigo. Vegetation is singularly luxuriant, and the forest trees are of the most magnificent description. Fruits, medicinal plants, fibrous vegetables, and dyeing woods abound. The flora includes the *Victoria Regia*, the largest of the water-lilies. Among the animals are the jaguar, tapir, armadillo, sloth, vampire bat, and alligator, and many species of birds, such as humming-birds and parrots. Snakes, some of them venomous, and troublesome insects are numerous. Guiana has two dry and two wet seasons, each continuing for three months: December, January, February, June, July, and August constitute the wet season, the other months of the year the dry. The mean annual temperature is nearly 81° 2′. Violent thunderstorms occur at the change of the seasons; but the hurricanes so destructive in the West Indies are unknown. In the dry seasons the climate is agreeable, and in the interior more healthy than in many parts of the West Indies. The trade is concentrated mainly in Georgetown, the capital. Sugar, rum, molasses, and gold are the principal exports, the first being by far the most valuable. The exports have recently varied in value in different years from about £2,193,120 (1913) to £4,240,032 (1919). The Government consists of a Governor, an executive council, a ‘ court of policy ’, and a ‘ combined court'. The court of policy consists of the Governor, seven official members, and eight elected members (who must be possessed of a fairly high property qualification), and its functions are legislative. The combined court consists of the court of policy, with six elected financial members added, and it has the power of imposing taxes and discussing the annual estimates. The Roman Dutch law is generally in force in civil cases, while the criminal law is based on that of Britain. There are a number of schools aided by Government, also estate schools for the instruction of children of immigrant labourers. Guiana was first visited by the Spaniards about 1500, and settled by the Dutch about 1580. It was taken by the British in 1781, but restored to the Dutch in 1783. Similarly, it was taken again in 1796, restored by the Peace of Amiens in 1802, retaken by the British in 1803, and definitely given up to them in 1815. Boundary disputes with Venezuela and Brazil were settled by arbitration respectively in 1899 and 1904. Pop. (1911), 296,000; estimated pop. in 1920, 305,991, of whom many are of African race or coolies from India.—BIBLIOGRAPHY: G. D. Bayley, *Handbook of British Guiana*; J. Rodway, *Guiana, British, French, and Dutch.*

Guiana, Dutch, or **Surinam,** a Dutch colony in South America, situated between British and French Guiana; area about 46,060 sq. miles. The general aspect is the same as that of British Guiana—flat and swampy on the coast, and mountainous in the interior; well watered by numerous streams, of which the Surinam and its affluents are the chief. It has also a similarly warm, moist climate, and is very fertile. Only a small part of the colony is under cultivation. On the Surinam River, about 10 miles from its mouth, is situated the capital, Paramaribo. The principal exports are sugar, coffee, molasses, and rum. The government is vested in the Governor-General and Council. Pop. (1919), 107,827.

Guiana, French, a French colony in South America, between Dutch Guiana and Brazil; area about 32,000 sq. miles. This territory resembles British Guiana in its physical features, climate, and vegetable productions, with the addition, among the last-named, of pepper, cloves, cinnamon, and nutmeg. The colony comprises the Island of Cayenne, celebrated for the pepper bearing that name. Gold has also been found in considerable quantities. The French are said to have first settled in Cayenne in 1604. Pop. (1918), 26,325.

Guicciardini (gwē-chȧr-dē′nē), Francesco, Italian historian, born at Florence 1483, died 1540. He became professor of jurisprudence at Florence, and held various public appointments. He began in 1534 his famous history of Italy—*Dell' Istoria d'Italia*—which embraces the period 1490–1534. It has been translated into English.

Guido Aretino (gwē′dō ȧ-re-tē′no), or **Guido d' Arezzo,** an Italian monk, celebrated for his skill in music, flourished in the eleventh century. He was a native of Arezzo, became a Benedictine monk, and finally prior of Avellana, where he died (1050). He invented the musical staff of lines and spaces (or at least systematized their use), and he introduced the names of the first six notes of the scale, *ut, re, mi, fa, sol, la.* He has explained his musical doctrines in his works *Micrologus* and *Argumentum Novi Cantus Inveniendi.*

Guido Reni (gwē′dō rā′nē), Italian painter, born at Calvenzano in 1575, died at Bologna 1642. Being the son of a musician, he devoted some time to the study of music, but, as painting seemed his true vocation, he was placed under the tuition of Dionysius Calvaert, and subsequently joined, in his twentieth year, the school of the Caracci in Bologna. In 1602 he visited Rome, where he studied Raphael and the antique, and having seen the paintings of Caravaggio, he imitated his style. At the request of Cardinal Borghese he painted *The Crucifixion of St. Peter* and the *Aurora.* He was also employed by Paul V to paint a chapel on Monte Cavallo, and one in Santa Maria Maggiore. Having quarrelled with Cardinal Spinola, the treasurer of Urban VIII, he left Rome and returned to Bologna, but was subsequently recalled. In 1622 he removed to Naples, but, after a brief stay, returned once more to Bologna, never to leave it again. He lived there in princely style, and died heavily in debt. Guido's paintings fall into three groups. His earliest pictures, under the influence of Caravaggio and the Caracci, display powerful contrasts of light and shade. In his second manner bright colour plays a greater part. His third period is marked by careless haste. Among his best-known works may be mentioned *Aurora, S. Mary Magdalene, Michael vanquishing Satan, Lot and his Daughters, Fortune,* and *Ecce Homo.* Guido was also celebrated in his own day for his etchings, the style of which was freely imitated.

Guienne, or **Guyenne** (gē-en′), an ancient province of France, now comprising the departments of Gironde, Lot, Lot-et-Garonne, Dordogne, and Aveyron, with part of Landes and of Tarn-et-Garonne. The capital was Bordeaux. It fell into the hands of the English in 1152, was nearly all conquered by Charles V in 1377, reconquered by Henry V and Henry VI, and finally annexed to France in 1453.

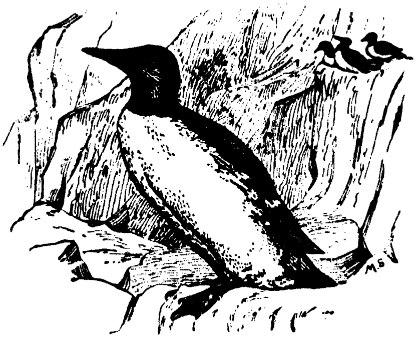
Guignet's Green (gē-nyā), a pigment prepared by heating in a reverberatory furnace a mixture of three parts of boracic acid and one of bichromate of potassium, made into a thick paste with water. This colour is quite fixed—it does not alter by light or reagents—and it is quite harmless, so that it forms an excellent substitute for the greens which contain arsenic and copper.

Guild, a society or association for carrying on commerce, a handicraft, or some other undertaking. Such associations are known from very early times in various countries. The societies of tradesmen exclusively authorized to practise their art, and governed by laws of their own, played a very important part in the Middle Ages. They often formed a bulwark against the oppression of the nobility, and were thus extremely conducive to the growth of municipal and civil liberty. Traces of these trade societies are found in the tenth century. In Milan we find the mechanics united under the name *credentia.* At Florence the trades were federated into twenty-one guilds or *arti.* These originated in 1282, on the overthrow of the nobility, and every candidate for citizenship was obliged to enter some particular guild. Such a step became a necessity at a period in which individual rights, as such, failed to secure respect. The purely Teutonic guilds, although connected with the constitution of the cities, possessed certain peculiarities. In the thirteenth century the German guilds of craftsmen obtained the right of defending by arms their own interests, and became so powerful that persons unconnected with a trade were often glad to attach themselves to them. As illustrations of the manner in which associations originally instituted for defensive purposes became the mainstay of a tyrannical monopoly may be mentioned, the frequent withholding of permission from more than a certain number of master mechanics to reside in one place, the restrictions placed upon particular branches of industry, and upon the free exercise, by each individual, of his trade except under the sanction of the guilds. In many ways the mediæval guilds resembled the modern trade unions. Both were founded to overcome tyranny, and both laid themselves open to the charge of tyranny. With the view of destroying the political influence which they had acquired, the Emperor Frederick II abolished them by a decree issued in 1240; but the decree remained without effect, as did also the clauses inserted with a similar view into the Golden Bull in 1356, and it was not until the last century that unrestricted freedom to practise any trade was established in the German states. In Austria this was done in 1860, and in 1868 it was done for all the states of the North German Confederation. In Britain trade guilds long possessed an importance which was mainly political. As the right of voting was involved in the membership of a guild, many persons, not mechanics, acquired the rights of ' freemen ' by connecting themselves with some body of this kind. These guilds, in England, had no legal right to prevent any man from exercising what trade he pleased. The only restriction on the exercise of trades was the statute of Elizabeth, requiring seven years' apprenticeship. This the courts held to extend to such trades only as were in being at the time of the passing of that statute; but by an Act passed in 1835, every kind of restriction on artisans and trades was abolished. The guilds or companies of the City of London (among the oldest of which are the weavers, founded in 1164; the parish clerks, in 1232; the saddlers, in 1280; the fishmongers, in 1284) are still very important corporations, which give relief to poor members, and also manage vast funds bequeathed for benevolent purposes. Besides the secular guilds there were from a very early period, in Britain, religious guilds. From the time of Henry II all such guilds were required to have a charter from the Crown. In 1388 a return of these guilds was ordered to be made, and it was then found that that of Corpus Christi, York, numbered 14,800 members. The property of the religious guilds was sequestrated in the reign of Henry VIII. In France guild-privileges were sold by the state from the tenth century till the revolution of 1789, but at that date guilds were entirely abolished. This was done also at a later period in Belgium, Holland, Italy, Sweden, and Denmark.—BIBLIOGRAPHY: Seligman, *Mediæval Guilds*; J. C. Thornley and W. L. Hastings, *Guilds of the City of London*; F. Armitage, *The Old Guilds of England.*

Guildford, a town of England, the county town of Surrey, on the Wey, a well-built and thriving place. It has an iron-foundry, corn-, paper-, and powder-mills, and an important grain market. It now gives name to one of the seven parliamentary divisions of the county. Pop. 24,927.

Guildhall, the city hall of London, Cheapside, first built in 1411, all but consumed in the great fire of 1666, and rebuilt in 1669. The front was not erected until 1789. The most remarkable room is the Great Hall, 153 feet long, 48 feet broad, and 55 feet high, used for city feasts. It contains the curious wooden statues of Gog and Magog. In the common council room is a collection of pictures (Guildhall Art Gallery, founded in 1885), some of them valuable. There is also a library in the Guildhall.

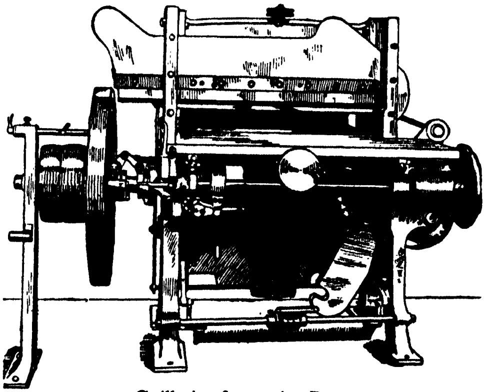
Guild Socialism, a theory for a fundamental reconstruction of society, based on communal ownership of the means of production, distribution, and exchange, the functions of administration and direction being vested in trade unions, which are to comprehend the whole of the workers in the industry concerned. The theory is an attempt to reconcile the purely anarchist conception of industry set out in syndicalism with the existence of some form of central state authority, but the numerous writers on guild socialism have so far failed to find a convincing statement of the nature of the central authority in their new scheme of things, or of the way by which the relations between the different *guilds*, as the organized industries are to be called, will be regulated. The intellectual origin of the movement was a strong reaction against state socialism, based on fear of the results of the concentration of the whole of the directive power of society in one authority, accompanied by a realization that the crude theory of syndicalism, that each industry should simply be owned and directed by the workers in it, left room for great inequalities between the workers in different industries. Accordingly, it is proposed that society shall be organized on a dual basis, the present state in a modified and limited form continuing as the representative of the interests of the inhabitants as 'consumers', while the parallel industrial organization of guilds, centralized in a 'Guilds' Congress', assumes responsibility for their interests as 'producers'. The point at which the theory is incomplete, and on which there is much divergence of view among guild socialists, is the relation between these two authorities. The driving force of the movement is a desire to carry into industrial life the movement towards democratic control which was the feature of political life of the nineteenth century, and its importance lies in the fact that it is the most convincing expression that has so far appeared of the aspirations of the workers to control their own lives, not only as citizens of a political state, but also as units in industry. It is to the credit of the movement that it has not been confined purely to theory, and that a serious attempt is now being made to apply its principles in the building industry, in which a number of 'Building Guilds' have been formed in different localities, and have succeeded in building houses economically and efficiently.



Guillemot (*Uria troile*)

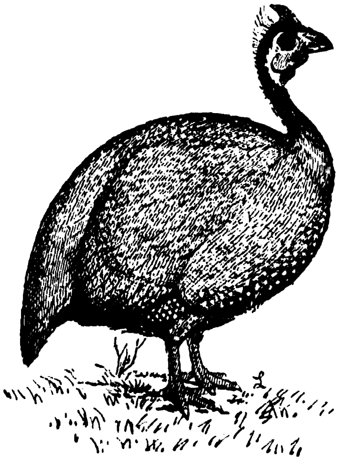
Guillemot (gil'e-mot), a name of several web-footed birds belonging to the family Alcidæ or auks. The guillemots have a straight, compressed, and pointed bill, covered with feathers as far as the nostrils, and have no hallux or hind-toe. The wings are pointed and very short, the legs also short, and placed far back. They live on fish, and build on precipitous rocks adjoining the sea. The common guillemot (*Uria troile*), about 18 inches in length, is frequently found in Britain, and lays one egg; the black guillemot (*Cepphus grylle*) is smaller, and lays two or three eggs.

Guillotine (gil-lo-tēn'), an engine for beheading persons at one stroke—an invention of the Middle Ages—adopted with improvements by the National Assembly of France during the first Revolution on the proposal of a Dr. Guillotine, after whom it is named. It was first used in Paris, at the Place de Grève, on 25th April, 1792. In this apparatus decapitation is effected by means of a steel blade loaded with a mass of lead, and sliding between two upright posts, grooved on their inner sides, the person's neck being confined in a circular opening between two planks, the upper one of which also slides up or down. The condemned is strapped to a board, which is able conveniently to rest horizontally on the table in front of the upright posts, but which is easily drawn forward and set upright when necessary, and again canted over upon the table and rapidly moved up so as to place the neck of the condemned within the semicircle of the lower plank, the other being raised for the purpose. On the right of the table is a large



Guillotine for cutting Paper

basket or trough of wicker-work for the reception of the body. Under the place where the head rests is an oblong trough for its reception. The knife is fixed to the cap or lintel on the top of the posts by a claw in the form of an 8, the lower part of which opens as the upper part closes. This claw is acted upon by a lever to which a cord is attached. When the head of the condemned is in position, the cord is pulled, and by the action of the lever the knife is set at liberty, descending by the grooves in the upright posts and falling upon the neck of the condemned just behind the planks which keep the head in position. The scaffold, which is surrounded by an open railing, is raised 6 or 7 feet from the ground. The same name is given to a machine which cuts by a knife descending between grooved posts, much used for cutting paper or straw.—Cf. Le Nôtre, *La Guillotine pendant la révolution.*



Guinea-fowl

Guimaraens, or **Guimaraes** (gē-mȧ-räṇs′), a town in Portugal, province of Minho, strongly fortified and well built. Pop. 8860.

Guinea (gin′ē), a geographical division of Western Africa, including the Atlantic coastline and an indefinite area of the interior between the frontiers of Senegambia and Cape Negro, or Cape Frio. It is divided into two districts, lying north and south of Cape Lopez: the former, called Upper Guinea, includes Sierra Leone, Liberia, the Grain, Ivory, Gold, and Slave coasts, and parts of Nigeria; the latter, called Lower Guinea, includes part of French Congo and Angola. See *Africa,* and the separate articles.

Guinea, an English gold coin worth 21*s.* sterling. Guineas were first coined, in the reign of Charles II (1663), of gold from Guinea, and bore the figure of an elephant. Its value ranged at different times from 20*s.* up to 30*s.*, until, in 1717, it was fixed at 21*s.* It was last coined in 1813, and in 1817 the coin was withdrawn from circulation. It is, however, still customary to pay doctors' and lawyers' fees, and subscriptions to charities, in guineas.

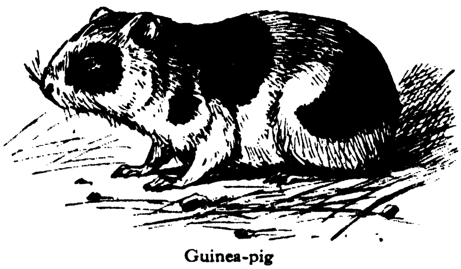
Guinea, Gulf of, that portion of the Atlantic which washes the shores of Upper Guinea, between Cape Palmas and Cape Lopez, and including the bights of Benin and Biafra. The islands of Fernando Po, Prince's, and St. Thomas are within this gulf.

Guinea-fowl, or **Pintado**, a genus of gallinaceous birds, family Phasianidæ or pheasants, originally all natives of Africa. The common guinea-fowl (*Numĭda meleagris*), now well known as a domestic fowl, has a slate-coloured plumage varied with round white spots. It is about the size of a common fowl, and is of a noisy and quarrelsome disposition. Its eggs are good eating. Among the other species of guinea-fowl may be mentioned the *Numĭda vulturīna* (or *Acryllium vulturīnum*) of Zanzibar, by far the most beautiful, with somewhat vulturine head and neck; the red-crowned *Numĭda mitrāta,* found in Madagascar; and the *Numĭda cristāta* of West Africa.

Guinea-grass (*Panĭcum maximum*), a very tall species of grass, a native of Africa, of the same genus as the millet, often 6 feet, and sometimes even 10 feet in height. It has been naturalized in South America and the West Indies, and largely cultivated for fodder. It does not perish even in Britain, but there it is not so productive as in warmer climates.

Guinea Pepper (*Xylopia aromatica*), a lofty tree of the same family as the custard apple. Its fruit, consisting of dry carpels, is used as pepper, 'Negro Pepper'. The term Guinea Pepper is often used as an equivalent for *Grains of Paradise,* or Malaguetta. It is also a common designation of *Capsicum frutescens.* See *Capsicum.*

Guinea-pig (*Cavia porcellus*), a well-known rodent mammal, family Caviidæ or Cavies. The name is probably a corruption of 'Guiana' pig. It is a native of South America (like the other



Guinea-pig

cavies), and resembles the pig only in its grunting. It is a timid little animal, extremely prolific, and it feeds on vegetables (especially parsley), bread, and grain. It is not an intelligent animal.

Guinea-worm (*Filaria medinensis*), a parasitic worm of the ord. Nematoda, white, of the thickness of pack-thread, somewhat attenuated at the hook-shaped posterior extremity. It varies in length from 6 inches to several feet, and it is found in the intertropical regions of the Old World. It is frequently found in the tissue of the human body below the skin, and produces a painful ulcer, out of which a small portion of the worm issues to eject its eggs. It is then carefully extracted by winding it round a stick once or twice every day, care being exercised not to break the worm. The embryos are parasitic in a small freshwater crustacean (Cyclops), and drinking-water is consequently the source of infection.

Guingamp (gaṇ-gäṇ), a town in France, department of Côtes-du-Nord, on the Trieux; has manufactures of linen, thread, &c., and several tanneries. Pop. 9385.

Guipuzcoa (gē-pụth'ko-ȧ), one of the three Basque provinces, in the N.E. of Spain, bounded N. by the Bay of Biscay; N.E. by France; area, 728 sq. miles. The coast is bold and rocky, and much indented; the interior is generally mountainous. The chief riches of the province are in its minerals, particularly iron, and its woods, which are used in smelting it. San Sebastian is the capital. Pop. (1920), 253,132.

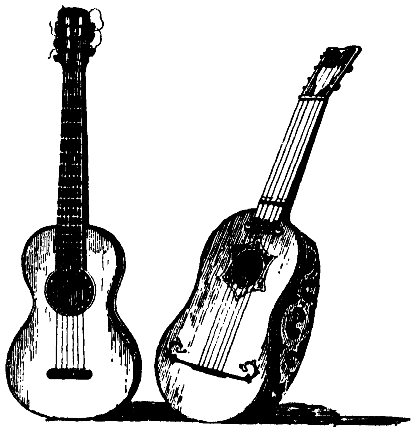
Guisborough (giz'bu-rō), a town in England, in the county of York (North Riding), situated in a narrow but fertile valley 9 miles S.E. of Middlesbrough. Cast-steel founding is carried on. Pop. 7105.

Guiscard (gis-kär), Robert (that is, *Robert the Cunning*), Duke of Apulia and Calabria, a son of Tancred de Hauteville, born in 1015, died in 1085. His brothers having acquired large possessions in Italy, Robert followed them about 1053, and in the same year captured Pope Leo IX at Civitella. On the death of his brother Humphrey he was proclaimed Count of Apulia in 1057. He then conquered Calabria, and Pope Nicholas II made him gonfalonier of the Church. Having become a tributary of the Holy See, and suppressed the privileges of the Apulian nobility, he sent his youngest brother, Roger, to seize Sicily. Robert himself arrived in Sicily in 1061, and, in conjunction with his brother, defeated the Saracens at Enna. Returning to Italy, Robert conquered the towns still remaining in the hands of the Saracens, being detained from 1068 to 1071 at the siege of Bari. In 1074 he was excommunicated by Gregory VII for refusing to become his vassal, but the ban was removed in 1080. As his daughter Helen was betrothed to the son of the Byzantine emperor, Michael VII, Guiscard, on the latter's deposition, took up arms in his favour, and defeated Alexis Comnenus at Durazzo (1082). As Gregory VII had been meanwhile imprisoned by the invading forces of Henry IV of Germany, Guiscard delivered the Pontiff in 1084. He then went again to Epirus, where he repeatedly defeated the Greeks, and, by means of his fleet, made himself master of many of the islands of the Archipelago. He was upon the point of advancing against Constantinople, when he died in the island of Cephalonia.

Guise (gwēz), a distinguished ducal family of France, a branch of the House of Lorraine. The founder was Claude, a son of René II, Duke of Lorraine, who in 1506 became naturalized in France. In his favour the county of Guise was erected in 1528 by Francis I into a duchy. He died in 1550, leaving behind him five daughters (the eldest of whom, Marie, married James V of Scotland, and was the mother of Mary, Queen of Scots) and six sons—François, who succeeded him, Charles (Cardinal of Lorraine), Louis (Cardinal of Guise), Claude, François, and René. The family acquired great political importance on the accession of Francis II, who was married to Mary, Queen of Scots. The direct line became extinct in 1675. In 1704 the title was revived for the House of Condé.—Two of the dukes require particular mention.—*François de Lorraine*, the second duke, born in 1519, early distinguished himself in war, especially at Metz, which he defended with success against Charles V, and at the battle of Renti, 1544. In his Italian expedition (1556–7) he failed to conquer the Kingdom of Naples. But he was successful in that which resulted in the final annexation of Calais to France. Under Henry II and Francis II he was the virtual ruler of France. On the death of Francis II the factions of Condé and Guise arose, the Protestants (Huguenots) being on the side of the former, the Catholics on that of the latter. When civil war broke out, the Duke of Guise took Rouen and Bourges, and won the battle of Dreux in 1562. He was preparing for the siege of Orleans, the central point of the Protestant party, when he was assassinated by a Huguenot nobleman, Feb., 1563. He left *Memoirs* written by himself.—*Henry*, third duke, eldest son of the preceding, was born in 1550. He was a bitter opponent of the Huguenots, and fought against them at Jarnac and Moncontour, and advised the massacre of St. Bartholomew (1572). To avenge himself he personally conducted the assassins to the house of Coligny. In 1576 was formed the Catholic League, first projected by his uncle, the Cardinal of Lorraine. A period of civil war followed; the party of Guise proved too strong for his opponents, and having brought about a rising of the Catholics in Paris (May, 1588), he entered the city in triumph. He might now have made himself master of the throne, but negotiations were set on foot, and the duke's displays of imprudent ambition led to his assassination in the king's Cabinet, 23rd Dec., 1588, at Blois, whither the estates-general had been summoned in order finally to ratify the treaty that had been arranged.—Bibliography: H. Forneron, *Les Guise et leur époque*; R. de Bouillé, *Histoire des ducs de Guise.*

Guise (gwēz), a town of France, department of Aisne, beautifully situated on the left bank of the Oise. It has manufactures of textiles, iron- and copper-foundries, &c., and a large work for making stoves, connected with which is an edifice in which live some 400 families of the working people. It is an ancient city, and its castle gave its title to the distinguished family of that name. Captured by the Germans in 1914, the town was recovered by the Allies in Oct., 1918. Pop. 8000.

Guitar (gi-tär′), a stringed instrument with a hollow body, and a neck somewhat similar to that of a violin, used especially to accompany the voice. The modern or Spanish guitar has six strings, the three highest of gut, the three lowest of silk covered with fine wire, tuned respectively to the E in the second space of the bass staff, A its fourth, and the treble D, C, B, and E. The intermediate intervals are produced by bringing the strings, by the pressure of the fingers of the left hand, into contact with the frets fixed on the keyboard, while those of the right pluck or twitch the strings. It is extremely popular in Spain. The Spaniards derived it from the Moors, who brought it from the East.



Modern. French seventeenth century.

Guitars

Guizot (gē-zō), François - Pierre - Guillaume, French historian and statesman, born at Nîmes 1787, died 1874. His father, a lawyer, having been guillotined in 1794, his mother and her three sons retired to Geneva, where François was gratuitously educated at the gymnasium. In 1805 he commenced legal studies at Paris, but gradually drifted into the literary profession. In 1812 he married Mlle de Meulan, and in the same year became professor of history at the Sorbonne. On the fall of the empire he obtained several public offices, such as Councillor of State, and director-general of the departmental and communal administration. In 1816 he published *Du Gouvernement représentatif et de l'état actuel de la France*, and *Essai sur l'instruction publique.* In 1820 the Duc de Berry was assassinated, and Guizot's party fell before an ultra-royalist reaction. In 1825 he was deprived of his chair on account of the political character of his lectures, but it was restored to him in 1828. In 1829 he again became Councillor of State, and in 1830 was elected Deputy for the arrondissement of Lisieux. After the July revolution he was appointed Minister of the Interior, but resigned in 1831. After the death of Périer, Guizot, along with Thiers and de Broglie, formed a coalition ministry, and he rendered great service as Minister of Public Instruction. He became Ambassador at the British court in 1840, and next year he became the real head of the Government of which Soult was the nominal chief. He retained the office of Minister of Foreign Affairs until 1848, and during that period opposed all measures of reform. After the fall of Louis Philippe, Guizot escaped and fled to England. Henceforth he practically retired from public life. Born of a Calvinist family, Guizot always remained a stern Protestant of the orthodox type, although he zealously supported the temporal authority of the Pope. Among his numerous works may be mentioned: *Histoire de la civilisation en France, Histoire générale de la civilisation en Europe, Histoire de la révolution d'Angleterre, Washington, Discours sur la révolution d'Angleterre, Méditations et études morales, Guillaume le Conquérant, Mémoires pour servir à l'histoire de mon temps* (1858 – 68), *Méditations sur l'état actuel de la réligion chrétienne, Mélanges biographiques et littéraires*, and *Histoire de France racontée à mes petits - enfants.* — Bibliography: Jules Simon, *Thiers, Guizot et Rémusat*; G. Bardoux, *Guizot* (in Les Grands Écrivains Français Series).

Gujerat, Gujarát, or **Guzerat,** a maritime province in Western Hindustan, Presidency of Bombay; total area, 70,000 sq. miles; pop. 11,000,000. The south-west portion is an extensive peninsula, with the Gulf of Kach (Cutch) on the north-west side, and the Gulf of Cambay on the south-east. The central districts form an extensive plain, but the northern and eastern districts are mountainous, rugged, and jungly. The rivers include the Narbada, Myhe, and Sabarnati. The climate is very hot in summer, and during the hot months the surface mostly appears sand or dust, and in the rainy season a thick mire; but it is extremely fertile. Gujerat comprises a number of native states within its area, the chief being the scattered territories of the Gaekwar or Guicowar of Baroda. The population presents an extraordinary assemblage of sects and castes. It gives name to the vernacular language of Northern Bombay—Gujaráti, spoken by about 10,682,000 persons. The area of the British portion, comprising the districts of Surat, Broach, Kaira, Panch Mahals, and Ahmedabad, is 10,226 sq. miles, and the pop. 3,100,000. The battle of Gujerat, between the British and the Sikhs, was fought on 21st Feb., 1849.

Gujranwála, a town of India, in the Punjab, administrative head-quarters of the district of the same name. It has inconsiderable manufactures of country wares, such as brass vessels. Pop. 29,470.—Area of district, 4082 sq. miles. Pop. 923,420.

Gujrát, a district of India in the lieutenant-governorship of the Punjab, in the Rawál Pindi division, between the Jehlam and the Chenab. Pop. 750,548.—*Gujrát*, the capital, 5 miles from the Chenab, is a commercial centre. Its manufactures are principally of cotton and of Gujrát ware, that is, inlaid work in gold and iron. Pop. 19,350.

Gulbar′ga, a town of India, in the state of Hyderabad. Pop. 34,437.

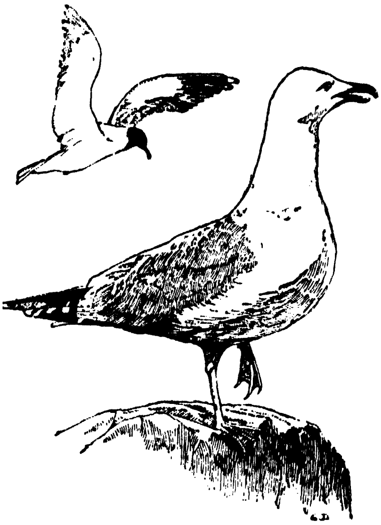
Guldberg, Cato Maximilian, a Norwegian mathematician and physicist, born at Christiania, 1836, died 1902. He was the eldest son of Carl August Guldberg, a clergyman. He was educated in the Royal Norwegian University at Christiania, and subsequently studied in France, Switzerland, and Germany. In 1869 he was appointed professor of applied mathematics in the Royal University, a position which he held until his death. He devoted himself from his student days to the study of chemical dynamics. At the age of twenty-eight he contributed a paper (in association with Professor Waage), on the Law of Mass Action, to the Society of Science in Christiania. This was followed by a second paper in 1867 entitled *Études sur les affinités chimiques*, and by a third paper in 1879, in which the theory of Mass Action was given in its final form. He contributed many papers to learned societies on physical chemistry.

Gulden, a silver coin of Austria-Hungary and also of Holland, worth, before the European War, about 1*s.* 8*d.* sterling. Also called a *florin.*

Guledgarh, or **Guledgud**, a town of India, in the Kaládji district, Bombay Presidency. Pop. 16,500.

Gulf Stream, one of the most celebrated of the oceanic currents, so called because it issues from the Gulf of Mexico. It owes its origin to the fact that the westward-moving waters of the tropical portion of the Atlantic, encountering the eastward projection of South America, become divided into two currents, one setting southwards along the Brazilian coast, and the other northward, past the mouths of the Amazon and Orinoco, into the Caribbean Sea. It then enters the Gulf of Mexico, and thence emerges through the Channel of Florida as the Gulf Stream. Its course is next to the north and eastwards, in a direction parallel to the coast of the United States, past Cape Hatteras (lat. 35° 13′), along the southern edge of the 'great banks' of Nantucket and Newfoundland (between the meridians of 48° and 60° west), after which its course as a distinct current cannot be traced. In the earlier part of its course, especially when rounding the extremity of Florida, the Gulf Stream forms a well-defined current, distinguished by its high temperature and its deep blue or indigo colour. On account of the descent of the Polar or Baffin Bay current along the coast in a direction opposite to that of the Gulf Stream, the water on its inland side is colder than that to the eastward of it. The difference of temperature between the Gulf Stream and this cold current sometimes amounts to 20° (or even 30°) F. The velocity of the Gulf Stream varies with its course. Within the Florida Channel it attains a mean of 65 miles per day; this sinks to 56 miles off Charleston, becomes 36 miles to 46 miles off Nantucket, and 28 miles to the south of the Newfoundland Banks; 300 miles to the eastward of Newfoundland its movement is hardly perceptible. At the bottom of the Florida Channel the observed temperature is 34°, that of the surface from 80° to 84°. Geographers have greatly exaggerated the influence of the Gulf Stream on the temperature of Europe. If it possesses any *direct* influence, such must be extremely small, as the current is both too narrow and too shallow, and its slight amount of superior heat probably vanishes after it has passed Cape Hatteras. The relatively high temperature of Western and North - Western Europe must rather be referred to the general set of the tropical waters to the north-east, and to the warm winds blowing in the same direction, and not to the Gulf Stream exclusively.—Cf. W. Ferrel, *Winds of the Globe.*

Gulf-weed (Sargassum), a genus of seaweeds (Algæ), sub-ord. Fucaceæ, of which one species, *S. Baccifĕrum*, grows on tropical coasts, and accumulates in great floating beds, but does not propagate when detached. It derives its ordinary name from the exploded idea that it is borne on the Gulf Stream from the Gulf of Mexico. Several areas of the ocean exhibit great quantities of this and other weeds floating on the surface. One such, the Sargasso Sea, is in the North Atlantic, lying south-west of the Azores, and north of the Tropic of Cancer.



Gulls

Lesser black-backed gull (*Larus fuscus*). Black-headed gull (*Larus ridibundus*) flying.

Gull (W. *gwylan*, Bret. *goelann*, gull), the general name of a sub-family (Larinæ) of birds distinguished by their straight bill, bending downwards towards the point, and marked below the under mandible by a triangular prominence, by their large wings, slender legs, palmated feet, and small hind-toe. Generally seen in large flocks, the larger species frequent the sea, the smaller, lakes or rivers. They swim well, but are incapable of diving. Their flight is rapid and long sustained. They are extremely voracious, and feed on every kind of animal food, putrid or fresh. Their principal food is fish, which they catch with great agility, darting down like an arrow. They breed only once a year, laying two to four eggs. The species are exceedingly numerous, and resemble each other greatly. Among the principal are the common gull (*Larus canus*), which breeds on the coast, or inland in moory districts; the lesser black-backed gull (*L. fuscus*); the black-headed gull (*L. ridibundus*), of which the masked gull (*L. capistrātus*) is only a variety; the Iceland gull (*L. leucopterus*), distinguished by its white quill feathers from the herring gull (*L. argentatus*); the great black-backed gull (*L. marinus*); the little gull (*L. minutus*); Sabine's gull (*Xema sabinii*); the kittiwake (*Rissa tridactyla*); the ivory gull (*Pagophila eburnea*).

Gum, a substance of various properties which exudes spontaneously from the bark of certain trees, such as the plum or the peach; or from incisions made in the bark to facilitate the flow. Gums form non-crystalline rounded drops or tears, the purest varieties being transparent or translucent, of a pale-yellow but sometimes of a dark colour. When dissolved in water, gum forms a thick, smooth fluid, with considerable viscosity. Some gums, such as gum-arabic, dissolve in water; others, like tragacanth, are only partially soluble; they are insoluble in alcohol. By being insoluble in alcohol gums are distinguished from resins. They have no odour, and only a very faint taste. The different kinds of gum receive their names from the countries from which they are imported—such as gum-arabic, gum-senegal, Barbary gum, and East India gum, and from individual features, as cherry-tree gum and tragacanth. *Gum-resins* require water and alcohol to dissolve them. See *Gum-resins.*

Gum-arabic is the purest form of gum, and may be regarded as typical. It comes from various species of Acacia, such as the *Acacia vera*, *A. seyal*, and *A. arabica* or *nilotica* (see *Acacia*). The gum exudes spontaneously, and its appearance is an indication of the tree being in an unhealthy condition; but in order to get it in sufficient quantity incisions are made in the bark. Gum-arabic is very largely employed in the finishing and dressing of fabrics; for thickening the colours in calico-printing; in pharmacy; as a cement; in ink-making; for making crayons and water-colour cakes, and for many other purposes. The purest gum-arabic is in round tears, transparent, and almost colourless, faintly odorous, completely soluble in water, the solution being feebly acid.

Gumbin'nen, a Prussian town, province of East Prussia, on the Pissa. It has brewing and distilling industries, and manufactures of woollen and linen cloth. During the European War severe fighting took place in the district of Gumbinnen, which was invaded by the Russians. Pop. 14,540.

Gumboil, an abscess in the gum, generally the result of toothache or of the presence of decayed teeth or stumps. The carious tooth or stump, if the inflammation proceeds from this cause, should be removed. The purulent matter should be evacuated by a free incision, and the mouth frequently washed with tincture of myrrh and water.

Gumming, a disease of certain fruit-trees, as cherries, plums, apricots, and peaches, consisting in a morbid exudation of gum, and generally resulting in the death of the tree.

Gum-resins, solidified juices obtained from plants. They contain a gum, which is soluble in water, and a resin, which dissolves in spirit, so that the body usually is nearly quite soluble in dilute alcohol; but there are usually present in addition essential oil, and a variety of impurities. The gum-resins have frequently a strong and characteristic taste and smell. They are solid, opaque, and brittle. The common gum-resins are aloes, ammoniacum, asafœtida, bdellium, galbanum, gamboge, myrrh, olibanum, opoponax, sagapenum, and scammony.

Gumti, or **Goomti**, a river of Hindustan, has its course in the United Provinces, and flowing south-east falls into the Ganges between Ghazipur and Benares. In its course it passes the cities of Lucknow and Jaunpur. Length about 500 miles.

Gun, a fire-arm from which projectiles are discharged by means of an explosion of gunpowder controlled by the firer. (See also *Cannon* for the use of the word in that connection; and *Machine-gun*; *Pistol*). The earliest form of portable fire-arm was known as a 'hand-gun', and was merely a plain metal tube attached to a straight piece of wood; this wood or stock was passed under the arm-pit, where it was held in position by pressure, and the charge was ignited by the simple method of putting a match or taper to the powder by way of the touch-hole left for the purpose in the closed end of the tube or barrel.

As, in course of time, the quality of powder improved and mechanical knowledge increased, an adaptation of this very primitive method was invented by which the necessary match was affixed to a 'cock' or hammer, and, by the action of a trigger mechanism, was brought down to a pan containing powder (the priming pan) connected with the main charge through a small hole into the barrel. This contrivance was known as the 'match-lock', and remained in general use till the seventeenth century. In the meanwhile experiments had been made with a view to the abolition of the match, which resulted in the production of the 'wheel-lock'. In this form of gun the priming pan was made of steel, and the cock took the form of a serrated wheel which was rotated against the priming pan by a mechanical device, and was supposed to produce sparks by which the priming powder would be fired. The invention, however, proved unsatisfactory, and the match-lock retained its position till it was supplanted in the middle of the seventeenth century by the 'flint-lock'. In this gun the cock was provided with screw jaws into which a prepared flint was fitted. The cock or hammer was then released by a trigger-operated spring, and, falling with considerable force on the steel priming pan, ignited the powder therein, and so the charge. For sporting purposes the flint-lock in its turn gave place to the percussion gun, in which the barrel was fitted with a small hollow nipple on which was placed a cap containing a fulminating material which, on being struck by the hammer, exploded the charge in the barrel. All these guns were, of course, muzzle-loaders, and their form was practically the same, whether they were used for military or sporting purposes, or for shot or ball; sporting guns were generally known as fowling-pieces, and were rather more ornate and carefully made than were the muskets provided for military use.

About the middle of the nineteenth century, assisted by the invention of the fulminating material referred to above, breech-loaders were beginning to come into use. For the sporting gun, or rifle, the method adopted (and still in use) was to have the barrel and stock in separate pieces. The barrel was attached to the fore-part of the stock by a species of hinge, and, by the application of certain mechanism, could be broken or opened downwards; the stock was provided with a false breech—to close the open breech of the barrel—and contained the firing mechanism. The first guns of this kind were known as pin-fire guns; that is to say, the cartridge containing the charge was provided with a pin which, when the cartridge was placed in the chamber or breech and the gun was closed and locked, fitted into a recess left for the purpose, and projected above the barrel. The hammer was then released, and, striking the pin, drove it downwards on to the cap of fulminating material contained in the base of the cartridge and exploded it. This system was later improved by the elimination of the projecting pin on the cartridge, and the substitution of a firing-pin in the false breech on the stock, which was so arranged as to strike a cap in the centre of the cartridge base when operated on by the hammer. This form was known as the central-fire gun.

In modern guns the hammer disappears entirely, and all the firing mechanism is contained inside the false breech, only the triggers appearing outside. All such guns are fitted with a safety device by which the firing mechanism can be put out of gear till required. The action of closing the gun after loading cocks or makes the gun ready for firing without any further action, so some such safety device is very necessary. See *Rifle*.—BIBLIOGRAPHY: F. Grose, *Military Antiquities*; T. F. Fremantle, *Book of the Rifle*; Lord Walsingham and Sir R. Payne-Gallwey, Bart., *Shooting* (Badminton Library); *Encyclopedia of Sport*.

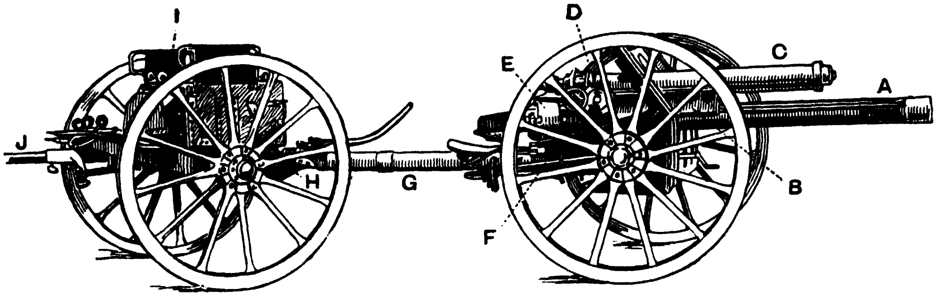
Gunboat, a term applied to small war-vessels mounting often only a single heavy gun, and employed in coast defence or in attacking large and heavy-armoured vessels. Some gunboats have their one gun on the deck mounted so as to be turned in any direction by means of a pivot. In others the single gun is placed on a platform, which can be raised to the deck or lowered to the hold. The gun in this case does not turn on a pivot, the manœuvring being effected entirely by the turning of the vessel. Some of the gunboats of the present day are armed with several powerful breech-loading guns besides quick-firing and machine-guns; and they may also be fitted for discharging torpedoes. Many of them are very swift.

Gun-carriage, the structure on which an artillery weapon is mounted and on which it is fired. Ancient weapons were rigidly attached to the gun-carriage, with the result that on the shock of discharge the whole carriage ran back, and the weapon had to be relaid after each round fired.

A modern gun-carriage must stand steady on firing. The gun itself recoils through a cradle on the carriage, so that in the first place it requires no running up, and in the second place it maintains the direction and elevation of the gun, so that only a very slight correction, if any, is necessary after each round. Modern field-gun carriages are so steady that a full glass of water can remain on the wheel during firing without spilling a drop.

Provision must be made in modern gun-carriages for (1) checking the recoil; (2) running up the gun again to the firing position after recoil; (3) giving the necessary elevation to the gun; (4) traversing, i.e. giving the necessary direction to the gun. In the case of field mountings, the gun and carriage are mounted on two wheels, and are generally united for travelling with a two-wheeled fore-part called the *limber*, to which the horses are attached, so forming a four-wheeled vehicle. In the case of heavy field-pieces, the limber and horses may sometimes be replaced by some form of mechanical tractor.

In action the gun is unlimbered, and the weight of gun and carriage is taken on the axle between its pair of wheels, and on a strong support, called the *trail*, stretching backwards and downwards from the axle. The carriage is maintained in position by the friction of the brakes on the wheels, and by a *spade* which is fixed to the rear end of the trail, and which bites into the ground on firing. The shock of discharge is taken up by one or more *buffers* interposed between the gun and the carriage. The gun is allowed to recoil several feet through a *cradle* fixed to the carriage, the buffer taking up much of the shock and communicating the rest gradually to the carriage, so that, instead of a violent jerk, there is a steady graduated pull. The buffer consists of a cylinder and piston. The gun on recoil draws this piston through the cylinder, thereby further compressing compressed air or steel springs, and forcing oil in the cylinder to flow from one side of the piston head to the other through small regulated ports. After firing, the gun is run up through the cradle of the carriage to the firing position again by the compressed air or springs reasserting themselves as soon as the shock of discharge is over. Elevation is generally given by means of a telescopic elevating screw under the breech end of the cradle, or by a toothed arc attached to the cradle, and gearing into a pinion on the carriage.



Gun-carriage

A, Gun. B, Cradle. C, Buffer. D, Range drum. E, Breech. F, Brake handle. G, Trail. H, Spade. I, Seat for gunners when travelling. J, Pole.

Traversing gear consists of an endless screw gearing into a toothed arc at the rear of the upper carriage. In field mountings the cradle and elevating gear may be mounted on an upper carriage pivoted vertically to the axle, or the whole carriage may be made to move along the axle-tree, moving about the spade as pivot.

Fixed carriages are those which are mounted on a solid base and not capable of being moved. *Disappearing carriages* are visible to the enemy only during the act of firing, the loading being effected under cover. A heavy counter-weight is used to bring the gun to the firing position, whilst the recoil brings it down into the loading position.

Gun-cotton. See *Explosives.*

Gun-licence. No person may use or carry a gun (including rifles, pistols, and air-guns) without an excise licence, which must be produced on demand. The following are exempt from this law: (1) persons in the army, navy, volunteers, or police when on duty; (2) gunsmiths; (3) common carriers; (4) persons holding game licences (see *Game Laws*); (5) occupiers of lands using a gun to scare birds or vermin; (6) persons carrying the gun of a licence-holder. A licence is not necessary for a gun used or carried in the owner's house or curtilage. The penalty for breach of the Act is a fine of £10. Gun-licences in the United Kingdom expire on 31st July; they cost 10*s.* a year.

Gun-metal, a variety of bronze containing approximately nine parts of copper and one part of tin. Originally used for ordnance, but now replaced by steel for this purpose. Commercial gun-metals are largely used for mechanical purposes when strong castings are required, the alloys containing from 88 to 92 per cent of copper. A small proportion of zinc is commonly added in order to increase the fluidity of the molten metal and thus assist in the production of sounder castings. This addition of zinc also softens the metal somewhat and facilitates machining. Small quantities of lead are added for the same purpose, but this is found to reduce the strength, especially when used at high temperatures.

Gunnel, or **Butterfish** (*Pholis gunnellus*), a small shore-fish which is the type of a family (Pholididæ) related to the blennies. The common gunnel resembles an eel, is about 6 inches in length, is brown in colour, and has black spots on the base of the dorsal fin. It is termed 'butterfish' on account of the mucous secretion of its skin. The female protects her eggs, sometimes assisted by the male.

Gunner, in the navy, is a warrant-officer appointed to take charge of the ammunition and ordnance of a war-vessel, and to have a general supervision of the weapons. A *chief gunner* is a commissioned officer. In the army a gunner is simply an artilleryman, or one who has to work and attend to the guns. The term is colloquially applied to all ranks in the Royal Artillery.

Gun′nera, a genus of plants, ord. Haloragidaceæ, one species of which (*G. scabra*), a native of South America, somewhat resembles the rhubarb, and is used as an ornamental plant. It has large rough leaves and astringent roots, while its leaf-stalks are a substitute for rhubarb.

Gunnery is the science of directing an artillery projectile so that it will strike a given target. The gun serves two purposes: first, to confine the propellant gases so as to allow them to act on the base of the projectile; and second, to give the projectile, called the *shell,* the proper direction. As the powder charge burns it is converted into gas of greatly increased volume. This gas, in its endeavour to expand, presses upon the base of the shell and drives it up the bore. So long as it continues to exert a forward pressure upon the base of the shell it continues to accelerate the motion of the shell, and the velocity of the latter goes on increasing till it passes out of the muzzle.

Theoretical gunnery involves the study of both internal and external *ballistics.* The former is the study of the motion of the shell down the bore of the gun and the pressure generated by the expanding gases on the shell and the gun itself. This pressure can be measured by special crusher gauges and plugs invented by Major Mansell, R.A. External ballistics concern the motion of the shell after leaving the bore, and the effects upon this motion of gravity, the resistance of the air, the shape and weight of the shell, atmospheric conditions, and wind. The velocity of the shell can be measured at any time during its flight by means of the Boulengé chronograph.

The path taken by a projectile in its flight through the air to the first point of impact is called the *trajectory.* This is always a curve, since, owing to the resistance of the air, the velocity of the shell is continually decreasing and the force of gravity is exerting a constant pull towards the ground. To allow for the fall of the projectile, it is necessary to point the axis of the bore as much above the mark aimed at as the projectile would have fallen below if the gun had been pointed straight. This angle of elevation is called the *range.*

In addition to the range it is necessary to give a second angle of either elevation or depression, according as the target is above or below the horizontal plane of the gun. This is called the *angle of sight.* When the target is visible from the gun, this angle is automatically put on by aligning the sights on the target. In *indirect laying,* when the target is not visible from the gun, this angle of sight must be calculated and given to the gun by means of a clinometer.

Direction or *line* is given to the gun by aligning the sights on the target when this is visible from the gun. When the target is not visible from the gun, the angle from some visible auxiliary mark is measured, and the gun laid for direction from this auxiliary mark.

Gunny-bags are bags made of a coarse cloth or sacking manufactured in India of some native fibre, chiefly jute. They are extensively used in India in packing rice, sago, spices, &c., for export, and in America for bales of cotton.

Gunpowder. The early history of gunpowder is very obscure. According to some authorities it was known to the Chinese in very early times, while others attribute the invention of it to Roger Bacon or to Berthold Schwartz, a German monk. If Roger Bacon did not invent it, he at any rate was one of the earliest writers to allude to it, which he did in his *De mirabili potestate artis et naturæ* (1242). It seems likely, however, that Bacon only knew gunpowder as an explosive, not as a propellant. Gunpowder seems to have been produced in England for the first time in the reign of Edward III (about A.D. 1345). It was not manufactured on a large scale until the reign of Elizabeth, when the works at Faversham were opened. It was still something of a novelty in Shakespeare's time, for he makes Hotspur speak of a certain lord denouncing " this villanous salt-petre " (*1. Henry IV*, i, 3, 60). According to Thomas Carlyle the three great elements of modern civilization were gunpowder, printing, and the Protestant religion. For the composition and details of the manufacture of gunpowder see *Explosives*.

Gunpowder Plot, a conspiracy formed in England in 1604, the second year of the reign of James I, by some Roman Catholics, to blow up the king and Parliament in order to be revenged on the Government for its severities against their religion. The time ultimately fixed for the execution of the plot was the 5th of Nov., 1605, when Parliament was to be opened by the king in person. The plot originated with Robert Catesby, Thomas Winter, and John Wright, and was at once made known to Guido Fawkes, a zealous Catholic, who had served in the Spanish army in Flanders, and to Thomas Percy, a relation of the Earl of Northumberland. These five were the original conspirators, but the plot was subsequently communicated to Sir Everard Digby, Ambrose Rookwood, Francis Tresham, Thomas Keyes, Christopher Wright (a brother of John), and to some Jesuit fathers and others. The conspirators took a house next the Parliament House, and their original plan was by digging under this house to undermine the House of Parliament. They eventually discovered, however, that there was a cellar right under the chamber of Parliament, which was occupied by a coal-dealer. They at once hired this cellar, and filled it with powder, faggots, and billets. The plot was discovered by means of a letter sent Lord Monteagle, a Catholic peer in favour with the court, who laid it before the Secretary of State, Cecil. It was a warning, couched in mysterious terms, not to be present at the approaching meeting of Parliament. Cecil showed it to some of the Council, and did nothing till the return of the king from a hunting party. On hearing the letter James at once divined its meaning, and declared that it referred to gunpowder. This led to investigation and to the arrest of Fawkes in the cellar, where a hogshead and thirty-six barrels of powder were discovered. It is now very generally thought that Tresham, the reputed author of the letter to Lord Monteagle, had previously informed his lordship of the plot, and that the sending and publication of the letter were merely intended as blinds. It seems also that Cecil, knowing the king's vanity, was desirous of making him the discoverer of the plot. Catesby, Percy, and the two Wrights were killed in defending Holbeach House, in which they had taken refuge, against the sheriff. Sir Everard Digby was tried and executed at Northampton; Tresham died in prison. Fawkes, Rookwood, Winter, and others were tried at Westminster on 27th Jan., 1606, and executed on the 30th and 31st.—BIBLIOGRAPHY: John Gerard, *The Gunpowder Plot and the Gunpowder Plotters*; M. W. Jones, *The Gunpowder Plot.*

Gunter, Edmund, an English mathematician and astronomer, who flourished in the reign of James I, and invented the instruments mentioned in the following articles. He was born in 1581, and died in 1626. Educated at Oxford, he became professor of astronomy in Gresham College, London, in 1619. He was the first to employ the terms *cosine*, *cotangent*, &c.

Gunter's Chain, the chain in common use for measuring land; so called from its inventor, Edmund Gunter. Its length is 66 feet, or 22 yards, or 4 poles of 5½ yards each; and it is divided into 100 links of 7·92 inches each. 100,000 square links make 1 acre.

Gunter's Scale, a scale having various lines upon it, of great use in working problems in navigation. This scale is usually 2 feet long and about 1½ inches broad. On the one side are marked scales of equal parts, and of chords, sines, tangents, &c.; on the other, scales of the logarithms of these.

Guntur, a town of Hindustan, Presidency of Madras, district of Kistna, 46 miles from Masulipatam, and 30 miles from the Coromandel coast. Pop. 25,000.

Gurjun, a thin balsam or oil, derived from trees of the genus Dipterocarpus, in Burmah and the Eastern Archipelago. It is used for mixing paints, preserving wood from the attacks of white ants, and also medicinally.

Gurkha. The name—pronounced Ghoorkha—by which the inhabitants of Nepal, on the north-east frontier of India, are generally known. The Gurkhas, from whom a large number of recruits for the Indian army are drawn, claim descent from Rajput immigrants from India who found their way into Nepal about the middle of the eighteenth century and established themselves in the district of Gurkha, from which point they overran the country and grafted themselves on the original indigenous inhabitants, a Mongoloid race. The Gurkha nation is divided into tribes and clans, the four principal being known as Khas, Thakurs, Magars, and Gurungs; of these the Khas are predominant and highest in the social scale. By religion they are Hindus or Buddhists, Hinduism being more prevalent, and they observe most of the Hindu caste rules, though they are not so particular as to ceremonial observances as are the more orthodox Hindus of India.

In build the Gurkha is a stout and sturdy little man, seldom over 5 feet 5 inches in height; as a soldier he has a considerable reputation, more especially in hill warfare, coming as he does from a country composed entirely of range upon range of steep and rocky hills. The national weapon of the Gurkha of all grades of society is the kukri, a short, curved, broad-bladed, and heavy knife about 20 inches long.

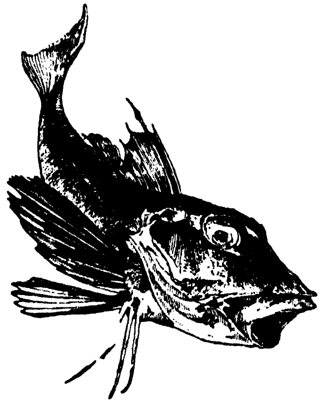
On one occasion only have Nepal and the Gurkha nation fallen foul of the British power. In 1814, owing to repeated incursions into British Indian territory, a campaign against Nepal became necessary; this, after some preliminary reverses, was finally successful, and the peace and subsequent alliance entered into in 1816 continues to the present day on the basis of mutual non-interference. In 1857 the Nepal Durbar (Government) sent a considerable number of its troops to assist in quelling the Mutiny; in 1914 the Durbar again provided troops to garrison Indian stations depleted for the requirements of the European War; and, in 1919—when unrest in India was very marked—the Prime Minister of Nepal wrote to the Viceroy offering " such help as it is possible for us to give, so that we may vindicate once again our century-old and honoured friendship ".

In our Indian army there are ten regiments of Gurkha Rifles—numbered 1 to 10—of two battalions each, of which the first three regiments were raised in 1815 from Gurkha soldiers who had fought against us in the first stage of the Nepal War.

As soldiers Gurkhas are very amenable to discipline, and give little trouble; they do not, however, always get on particularly well with natives of India, on whom they are inclined to look down. They are very much addicted to sport of all kinds, and are fond of associating with the British soldier on terms of equality.

Examples of Gurkha names are: Amar Sing Thapa, Lalbir Limbu, Dhanbir Gurung, Harak Sing Gharti. Gurkhas do not wear the pagri or turban otherwise universal in the Indian army; instead, they wear a round forage-cap in full dress, and for ordinary and service purposes the slouch hat turned up on one side. They also wear short knickerbockers ending just above the knee, a most suitable kit for hill work.

Gur'nard, or **Gurnet**, the popular name of spiny-finned fishes belonging to Trigla and related genera. The head is angular and wholly covered with bony plates. The body is elongated, nearly round, and tapering; there are two dorsal fins; the pectoral fins are large, with finger-like appendages; the teeth are small and numerous. The grey gurnard is the *Trigla gurnardus*, common on the British coast: the red gurnard is the *T. cucūlus*, also common on the same coasts; other familiar species are the sapphirine gurnard (*T. hirundo*) and the piper (*T. lyra*). Flying gurnards (Dactylopterus), which can move short distances through the air, inhabit the Mediterranean, Atlantic, and Indian seas.



Red Gurnard (*Trigla cucūlus*)

Gusta'vus I, commonly called *Gustavus Vasa*, was born in 1490, or, according to others, in 1496, died in 1560. He was the son of Eric Johansson, a Swedish noble, served under Svante Sture, the administrator of the kingdom, was treacherously carried off with other noble Swedes by the King of Denmark, and kept a prisoner in Jutland for more than a year, but at length escaped. After many dangers he reached Dalecarlia, where he roused the peasants to resist Danish oppression, defeated the Danes, took Upsala and other towns, and in 1523 was elected king. In 1529 he procured the abolition of the Roman Catholic religion in Sweden, and established Protestantism. During his long reign Sweden made great progress in commerce and civilization.—Cf. R. N. Bain, *Scandinavia.*

Gustavus II (*Gustavus Adolphus*), King of

Sweden, a grandson of Gustavus Vasa, was born in 1594, and received a most careful education. He was trained to war under experienced generals, took his place in the State Councils at the age of sixteen, and was in command of the army in his seventeenth year during the war with Denmark, which was concluded in 1613, and by which Sweden recovered important possessions on the Baltic. He then turned his arms against the Russians, drove them from Ingria, Karelia, and a part of Livonia, which were secured to him by the Peace of Stolbova in 1617. He was then engaged in a war with Poland, which lasted nine years, and was concluded on advantageous terms for Gustavus in Sept., 1629, he being allowed to retain important conquests in East Prussia. His attention was now diverted from northern wars by the affairs of Germany. The oppression of the Protestants by Ferdinand II excited his sympathy, and the progress of Wallenstein alarmed him. Probably also he was moved by the ambition of foreign conquests. He embarked for Germany in 1630 with about 20,000 men, landed near the mouth of the Oder, and in a short time had seized nearly all Pomerania. After taking many fortified towns, repeatedly defeating the imperial generals, at Leipzig (1631), Würzburg (1631), Passage of the Lech (1632), and conquering a great part of Germany, he was killed in the battle of Lützen, against Wallenstein, 16th Nov., 1632. (See *Thirty Years' War.*) Though a severe disciplinarian, he was beloved by his soldiers, and the prestige of success derived from his victories lasted long after his death. — BIBLIOGRAPHY: J. L. Stevens, *History of Gustavus Adolphus*; C. R. L. Fletcher, *Gustavus Adolphus.*

Gustavus III, King of Sweden, born in 1746, succeeded his father, Adolphus Frederick, in 1771, and died 29th March, 1792. Finding the country weary of the misrule of the nobles, he gained the good-will of the army, surrounded the Assembly of the States-General, and forced them to accept a new Constitution which much restricted their privileges. In 1788 he took command of the army against Russia and Denmark, and stormed the defences of Fredericks-hall, destroying a great number of vessels. In 1789 he executed another *coup d'état*, arresting the opposition leaders, and passing a law extending the royal prerogative. On the outbreak of the French Revolution he made strenuous exertions to form a coalition between Russia, Denmark, Sweden, and Spain, but while preparations were being made a conspiracy of the nobles was formed against him, and he was shot at a masquerade by Ankarstroem, a disbanded officer, on 16th March, 1792. He died thirteen days later.—Cf. R. N. Bain, *Gustavus III and his Contemporaries.*

Gustavus IV (*Adolphus*), King of Sweden, was born on 1st Nov., 1778, and succeeded his father 29th March, 1792. On assuming power Gustavus showed that he had inherited his father's hatred of the principles of the French Revolution, which he carried to the extent of fanaticism. After the Peace of Tilsit he exposed himself to a war with Russia while he was at war with France, by refusing to join the continental blockade and opening his ports to England; and in 1808 he quarrelled with England, his only ally. Finland was lost to Sweden, and in 1809 a revolution took place. Gustavus was dethroned, and his uncle, the Duke of Sudermania, proclaimed king under the title of Charles XIII. Gustavus died in poverty at St. Gall, 7th Feb., 1837.—Cf. Sophie Elkan, *An Exiled King, Gustaf Adolf IV of Sweden.*

Güstrow (güs'trō), a town of Germany, in Mecklenburg-Schwerin, on the Nebel. It is well built, has a cathedral, a fine old castle, and an ancient and beautiful palace, once the seat of the Dukes of Mecklenburg - Güstrow. It served as an internment camp during the European War. Pop. 17,805.

Gutenberg, Johan, the reputed inventor of printing with movable types, was born at Mayence or Mainz about the end of the fourteenth century. Little or nothing is known of his early life. In 1434 he is said to have been living in Strasbourg, and in 1436 to have started or attempted to start a printing office there; but this seems false. In 1448 we find him at Mainz, where he formed, two years after, a copartnership with Johann Fust, and established, mainly with the money of the latter, a press, in which the *Mazarin Bible*, the *Letters of Indulgence*, and the *Appeal against the Turks* were printed. After five years this connection was dissolved, and Fust sued Gutenberg for large advances which he could not pay, and by a judgment at law obtained possession of most of the printing materials, with which, in company with his son-in-law Schöffer, he continued to print books. After this, according to some, Gutenberg carried on a separate printing establishment; but this is doubtful, and there is no book or printed matter which can certainly be ascribed to Gutenberg after the date 1454. Gutenberg seems to have died at Mainz in 1468. —Cf. J. H. Hessels, *The So-called Gutenberg Documents.*

Guthrie, Thomas, a Scottish divine, born at Brechin, Forfarshire, in 1803, died 24th Feb., 1873. Educated at the University of Edinburgh, he was licensed as a preacher in connection with the Church of Scotland in 1825. He did not at once exert himself to procure a church, but assisted his father in the business of his banking office, and also spent a winter

(1826–7) in Paris studying medicine. In 1830 he was presented to the parish of Arbirlot, and he accepted a call to Greyfriars, Edinburgh, in 1837, where he soon became very popular with all classes. In 1843 the Disruption took place, and Guthrie took an active part along with Chalmers and Candlish in organizing the Free Church. He himself became minister of Free St. John's, Edinburgh. The work with which his name is chiefly identified out of Scotland was the introduction into Edinburgh of the ragged-school system, then recently originated in London and Aberdeen. Into this work he threw himself with characteristic energy, employing in it both his personal labours and his pen. His *Plea for Ragged Schools* (1847) remains one of the most celebrated of his productions. In 1849 he received the degree of D.D. from the University of Edinburgh. In 1864 Dr. Guthrie was compelled in consequence of heart disease to resign the pastorship of St. John's. The remaining years of his life were spent in active promotion of philanthropic objects. He became editor of the *Sunday Magazine* in 1864, but never assumed full editorial responsibility. His chief works are: *The Gospel in Ezekiel* (1855), *A Plea for Drunkards* (1856), and *Christ and the Inheritance of the Saints* (1858). An *Autobiography and Memoir* has been published by his sons.

Gutta-percha (pėr'cha; Malay name, meaning 'gum-tree'), a substance resembling caoutchouc in many of its properties, but stronger, more soluble, and less elastic. It is the inspissated milky juice of *Palaquium Gutta* and other kindred trees of the nat. ord. Sapotaceæ. It chiefly comes from Malacca, Borneo, and other islands of the Indian Archipelago. When pure, gutta-percha is of a brownish-red colour. Below the temperature of 50° it is as hard as wood and excessively tough. By an increase of heat it becomes more flexible, until at a temperature of 115° F. it becomes pasty, and between this and 140° or 150° it may be moulded into all varieties of forms with the greatest ease, retaining precisely the same form as it cools and hardens to its previous state of rigidity. It is insoluble in water, soluble with difficulty in ether and other caoutchouc solvents, but very readily in oil of turpentine and naphtha. It is not attacked by solutions of alkalies nor by hydrofluoric acid, but it is acted on by sulphuric, nitric, and hydrochloric acids. Gutta-percha has been applied to a variety of purposes: as a substitute for leather, especially in the soles of shoes, &c.; as an insulating coating for the copper wires of submarine telegraph cables; as an ingredient in mastics and cements; for the manufacture of flexible hose-tubes and bottles. The amount of gutta-percha now produced yearly is declining considerably.

Guttif'eræ, a natural order of dicotyledonous trees or shrubs, which generally secrete an acrid, yellow, resinous juice, in some cases of considerable value, as the gamboge yielded by the *Garcinia Hanburyi* and allied species. They are found in the humid and hot places of tropical regions, chiefly South America. The fruit of some is highly esteemed, in particular the mangosteen and the mammee apple.

Gutzkow (gụts'kō), Karl Ferdinand, German writer, born at Berlin in 1811, died in 1878. After studying theology he took to journalism and politics, and became the leading spirit of a small body of reformers known as 'Young Germany'. In 1835 his novel *Wally, die Zweiflerin* appeared. It was at once suppressed by the Government as hostile to religion and society, and the author was imprisoned for three months. In spite of Government prohibition Gutzkow managed to publish a number of works from Hamburg, where he had settled. Amongst these are: *Blasedow und seine Söhne* (1838), a satire, and *Börnes Leben* (1840). He was active, also, in dramatic literature, his tragedies *Richard Savage* (1840), *Patkul* (1841), and *Uriel Acosta* (1847), and his comedies *Zopf und Schwert* (1844), and *Das Urbild des Tartufe* (1847), having been very popular. In 1842 he left Hamburg, and after a visit to Paris, described in *Briefe aus Paris*, settled at Frankfort till 1847, when he became director of the Dresden theatre. Here he devoted himself to novel-writing, producing the romances *Die Ritter vom Geist* (1850), *Der Zauberer von Rom* (1858), and *Hohenschwangau* (1868).—Cf. J. Dresch, *Gutzkow et la jeune Allemagne*

Gützlaff (güts'låf), Karl, a German missionary, born in 1803, died in 1851. He went out as a missionary to the Battas in Sumatra in Aug., 1826, but settled instead in Batavia, Singapore, and Siam. In 1831 he went to China, acted as British interpreter during the first Chinese War, visited Europe in 1849, and died at Victoria, Hong-Kong. His principal works are: *Journal of Three Voyages along the Coast of China in 1831, 1832, and 1833* (London, 1834); *China Opened, or a Display of the Topography, History, &c., of the Chinese Empire* (1838); *Geschichte des Chinesischen Reichs* (Stuttgart, 1847).

Guy (gī), Thomas, English philanthropist, the founder of Guy's Hospital, London, the son of a lighterman in Southwark, was born in 1645, and died in 1724. Brought up a bookseller, he dealt largely in the importation of Bibles from Holland, and afterwards contracted with Oxford for those printed at that university. His principal gains, however, arose from dealings in South Sea stock in 1720. He amassed a fortune of nearly half a million sterling, of which he spent upwards of £200,000 in building and endowing his hospital in Southwark, besides erecting almshouses at Tamworth and supporting various other charities. He was member of Parliament for Tamworth from 1694 to 1707. See *Guy's Hospital.*

Guyau, Jean Marie, French philosopher, born at Laval 28th Oct., 1854, died 31st March, 1888, at Mentone. He was a son, by her first marriage, of Mme Fouillée, who wrote under the pseudonym of G. Bruno. At the age of nineteen he wrote a prize essay, *Mémoire sur la morale utilitaire, depuis Épicure jusqu'à l'école anglaise,* which was crowned by the Academy. Appointed tutor of philosophy at the Lycée Condorcet in 1874, he had to resign his post on account of ill-health, and lived until his death in the south of France. Guyau's philosophy is a modified evolutionism, and life and art are the two fundamental ideas of his philosophy. According to him only two things defy criticism: life and beauty. The development of both life and art is only possible in society, and the sociological idea consequently becomes the third fundamental principle of Guyau's philosophy. He has been rightly called ' un remueur des idées ', for he was a critic rather than a constructive scholar and philosopher. One of his theories was that altruism is instinctive and not artificial, and tends to be diminished or even destroyed when it becomes conscious. His works include: *Vers d'un philosophe* (1881), *La Morale Anglaise contemporaine* (1885), *L'Irreligion de l'avenir* (1887), *La Genèse de l'idée du temps* (1890).—Cf. A. Fouillée, *La Morale, l'Art et la Religion d'après Guyau.*

Guynemer, Georges, French airman, born 1894, killed in 1917. Obtaining his pilot's certificate in 1915, he was promoted lieutenant and captain in 1917, having brought down numerous enemy aeroplanes. He became the champion ' ace ' of the French air force, and had already brought down over fifty German aeroplanes when he was shot in an air-duel with Wissemann. He had received the Military Medal, been made an officer of the Legion of Honour, and his name was placed on the commemorative tablets of the Panthéon.

Guy of Warwick, an old English metrical romance, whose hero is an Anglo-Danish knight said to have been the son of Siward, Baron of Wallingford, to have become Earl of Warwick, and to have slain in single combat the Danish giant Colbrand, the Dun Cow of Dunsmore, and the dragon of Northumberland, and to have performed many other wonderful feats. He is said ultimately to have become a hermit in Warwick.

Guyon (gē-yōṇ), Jeanne-Marie Bouvier de la Motte, Madame, a celebrated mystic, the introducer of the system of Quietism into France, was born at Montargis 13th April, 1648, died 9th June, 1717. At the age of sixteen she was married to Jacques Guyon, after whose death in 1676 the tendency to mystic enthusiasm which had characterized her younger years again acquired ascendancy, and she began the religious propagandism of her extreme views of self-abnegation, indifference to life and death, and even to future salvation or perdition. She became associated with some enthusiastic priests, abandoned her children and her goods, reserving a moderate annuity, and moved from place to place, making numerous proselytes. She also published numerous works, such as *Le Cantique des Cantiques interprété selon le sens mystique* (1685), *Poésies spirituelles* (5 vols., 1685), and *Discours chrétiens et spirituels* (1716). At last the Archbishop of Paris thought it necessary to take steps against the spread of Madame Guyon's mystical doctrines. Through his influence she was shut up in the convent of the Visitation, but afterwards released at the instigation of Madame de Maintenon, who herself became for a time a convert to the new doctrines, and allowed Madame Guyon to preach in the seminary of St. Cyr, where she made a convert and disciple of Fénelon. A commission of ecclesiastics, chief amongst whom was Bossuet, now sat in judgment, and the doctrines of Madame Guyon were condemned (1695). This led to her being imprisoned for some years, afterwards in the Bastille, whence she was liberated in 1702. The rest of her life was spent in retirement and in works of charity. —Bibliography: T. Upham, *Life, Religious Opinions, and Experiences of Mme Guyon*: L. Guerrier, *Mme Guyon, sa vie, sa doctrine, son influence.*

Guyot, Yves, French politician and economist, born at Dinan, Côtes du Nord, 6th Sept., 1843. Educated at Rennes, he came to Paris, where he contributed to several papers. Editor of *Le Siècle* from 1892 to 1903, he advocated social and political reforms. Elected to the Chamber of Deputies in 1885, he was Minister of Public Works from 1889 to 1892. Guyot became known as a champion of industrial freedom, an opponent of protection and socialism, and an authority on financial questions, and was appointed editor of the *Journal des Économistes* in 1909. His works include: *Études de physiologie sociale* (1882), *La Science économique* (1881), *L'Impôt sur le revenu* (1887), and *La Tyrannie socialiste* (1893). With A. Raffalovitsh he edited the *Dictionnaire du commerce, de l'industrie et de la banque* (1898–1901).

Guy's Hospital, a London hospital, founded in 1723 by Thomas Guy (see *Guy, Thomas*). The original building, completed in 1725 and endowed at a cost of over £200,000 (in addition to the cost of erection), contained accommodation for 400 sick or incurable persons. By an Act of

Incorporation obtained shortly after Guy's death, the hospital property and management were vested in fifty gentlemen as perpetual governors. Part of the money was invested in landed property, and the estates now belonging to the hospital yield an annual income of £40,000. The hospital buildings have been greatly improved and enlarged in modern times, more especially by means of a bequest in 1829 of £190,000 from William Hunt, one of the governors, and the hospital is now the largest in London, the beds amounting to 643. Attached to the hospital is an extensive medical school, containing lecture-rooms, museums, and a medical library. There are usually about 350 students at the hospital medical school, with which many eminent names in the medical world are associated. A chapel forms part of the hospital buildings, with a fine statue of the founder, whose remains, along with those of Hunt and Sir Astley Cooper, rest in the vault beneath.—Cf. S. Wilkes and G. T. Bettany, *History of Guy's Hospital.*

Gwal'ior, a city and fortress of Hindustan, capital of the state of Gwalior, situated about 65 miles south of Agra. The fortress is the largest, the strongest, and the most magnificent of the native fortresses in India. It stands on an isolated rock about 340 feet high and nearly perpendicular in the upper part, being partly made so by art. The rocky mass has a length of 1½ miles, a greatest breadth of 300 yards. The fortress contains wells and reservoirs of water, and is inaccessible except by steps up the side of the rock. Notwithstanding its natural strength, it has been wrested from the natives by the British oftener than once. Old Gwalior, the town at the eastern base of the rock, is built of stone, and has some remarkable ruins of temples and an interesting example of old Hindu palace architecture. One of the temples is now known as *Sāsbahū*, derived from *Sahasra-bahu*, an epithet of Siva, and meaning 'the thousand-armed'. It is decaying, and a new town, known as New Gwalior or Lashkar (the camp), the residence of the ruler, Maharajah Sindhia, has sprung up on the south-eastern skirt of the rock, and is a flourishing city with a large area and a population of 70,880, of whom the majority are Hindus. It possesses various educational and benevolent institutions, including Victoria College, founded in commemoration of Queen Victoria's diamond jubilee, high school, girls' school, hospital, museum, and palace.—The state of Gwalior, in political relationship with the Government of India, and connected with the Central India Agency, consists of several portions of territory, otherwise known as Sindhia's Dominions, the largest and most compact portion, usually known as Gwalior, being the one containing the above town and fortress. The total area of Gwalior is 25,133 sq. miles. The drainage is chiefly taken by the Chambal, which forms part of the boundary on the north-west and north-east and finally joins the Jumna. The products are those which are generally produced in India: grains and pulse of various kinds, oil-seeds, considerable quantities of cotton, and in the south-west and south opium, that goes under the name of Malwa. Pop. 3,100,000.

Gwyn'iad, or **Gwiniad** (Welsh name, from *gwyn*, white), the *Coregŏnus pennantii*, a fish of the salmon or trout kind found plentifully in Lake Bala. It is gregarious, and may be taken in great numbers at a draught. It is closely related to the *Houting*, *Pollan*, *Powan*, and *Vendace* (q.v.).

Gwynn, Eleanor, better known by the name of *Nell*, a celebrated mistress of King Charles II, was born of humble parentage in 1650; and died in 1687. She was at first an orange girl in Drury Lane Theatre, but took early to the stage, her first performance being in 1665 in *The Indian Emperor* of Dryden. She acted in many parts both in tragedy and comedy, though she was best in comic parts. About 1667 she became the mistress of Lord Buckhurst, who surrendered her about 1670 to the king. As mistress of the king she had an establishment, and was made lady of the privy chamber to Queen Catherine. She was merry and open-hearted, is said to have been faithful to Charles, was mindful of old friends, and a liberal patroness of the poets Dryden, Lee, Otway, and Butler. From her are sprung the Dukes of St. Albans, but she herself received no title. She is repeatedly spoken of in Pepys's *Diary*.—Cf. C. Chesterton, *Nell Gwyn*.

Gyges (gī'jēz), a king of Lydia who reigned, according to Herodotus, 716–678 B.C. He was the favourite of the Lydian king Candaules, who, to convince him of the beauty of his queen, showed her to him naked. The queen was so incensed that she ordered Gyges either to murder the king, ascend his vacant throne, and become her husband, or to atone for his curiosity by death. He chose the former.

Gymkhana (jim-ka-na; Hind. *gend-khanah*, ball-house, or Eng. *gym*, short for gymnasium, and Pers. *khanah*, house), a term employed by Anglo-Indians, soldiers as well as civilians, to designate the grounds and buildings used for athletic recreation. The word is also applied to outdoor meetings arranged for sporting events and recreation purposes.

Gymna'sium (jim-), the name given by the Greeks to the public building where the young men, quite without clothes (hence the name, from *gymnos*, naked), exercised themselves in leaping, running, throwing the discus and spear, wrestling, and pugilism. Its objects, however, were extended also to the exercise of the mind;

for here philosophers, rhetoricians, and teachers of various branches of knowledge delivered their lectures. Gymnasia were afterwards composed of a number of connected buildings, spacious enough to admit many thousands. The name is similarly used at the present day. See *Gymnastics.*

Gymnasium, a term applied in Germany to a class of schools corresponding pretty nearly to the grammar-schools and secondary schools of Britain. Formerly in the gymnasia Latin and Greek were the chief subjects taught; but a more practical bent is given to the course of instruction in these institutions now, though the *real-schools,* as they are called, are the institutions specially established for high-class education in such branches as mathematics, physical science, and modern languages. The gymnasia are the feeders of the universities. The last or exit-examination, to show whether the pupils are fit to enter the university, is very severe, and includes not only Latin and Greek, but also mathematics, physics, history, &c., and at least one foreign language (French or English).

Gymnastics (for derivation, see *Gymnasium*) is the technical term used to designate any system of exercises specially designed to promote the development of physical, and especially of muscular powers. An excellent gymnastic training is given by cricket, football, rowing, and similar amusements, but the special value of formal gymnastic exercises is that they are capable of being scientifically arranged so as to secure not only a general development of muscular power, but also an accurate knowledge of the uses of the various muscles, and further that they are capable of being applied to each individual case, so as to meet, allow for, and as far as possible overcome defects in physical organization. For these purposes an elementary course of gymnastics is of great value to all, especially to the sedentary student. In regard to gymnastic exercises two general rules may be laid down, which will form an efficient guide in self-imposed exercises. The first is the universal rule in mechanics that the strength of any machine is the strength of its weakest part; the second is the fundamental law of muscular exercise, that it is exercise within the extreme power of the muscle which develops and improves, while straining weakens and injures, and excessive exercise develops particular muscles abnormally at the expense of the general health. Till the age of twelve the ordinary games and pastimes of childhood are generally quite sufficient exercise; after that some very light system of gymnastics may be adopted. After the age of thirty-five unusual muscular efforts are apt to leave persistent strains, and moderate exercise becomes the safest means of developing and giving tone to the muscular system. Places fitted up with special appliances for gymnastics are called gymnasiums, the appliances being such as horizontal and parallel bars, trapezes, vaulting-horses, ladders, climbing-poles and ropes, &c. Apparatus of various kinds is also made for being readily fitted up in private houses.

Gymnema, a genus of Asclepiadaceæ. The leaves of *G. sylvestre,* when chewed, temporarily destroy the power of tasting sweet substances.

Gymnos′ophists (jim-; Gr. *gymnōs,* naked, and *sophistēs,* philosopher), a name given by the Greeks to certain Indian philosophers given to meditation and ascetic practices, corresponding in some respects with the yogis, modern fakirs or naked devotees.

Gymnosperm (jim′-), a plant with a naked seed, a term used in contrast to *Angiosperm.* The gymnosperms include pines and firs, yews and cycads. There is no ovary, the pollen coming into direct contact with the micropyle of the ovule without the intervention of a stigma.

Gympie (gimp′i), a municipal town of Australia, in Queensland, on the side of a range of hills overlooking the River Mary, 116 miles north of Brisbane. It owes its origin to the rich gold-reefs here, which are worked to a great depth. The town has some good public buildings, well-paved streets, and a public water-supply. Pop. 12,419.

Gynæceum (ji-nē′sē-um), in botany, the pistil taken in a collective sense, precisely as the stamens form the andrœcium, the petals the corolla, and the sepals the calyx.

Gyöngyös (dyeun′dyeush), a town, Hungary, 44 miles north-east of Budapest; it has manufactures of woollen stuffs, an active trade, and produces the celebrated Erlauer red wine. Pop. 18,315.

Gypsies (from *Egyptians,* the name by which they were called in the English statutes, possibly because they were supposed to have come from Epirus, known as Little Egypt) a wandering nation whose physical characteristics, language, and customs differ much from those of European nations. They are called by the French *Bohémiens,* from the belief that they were Hussites driven from Bohemia; in Germany the general name is *Zigeuner,* which is not unlike the Italian *Zingari.* They call themselves *Romany,* from *rom,* a word applied to the Byzantine Empire and still preserved in the name Roumania. The race is slowly melting away, and its total number in Turkey, Hungary, Transylvania, Spain, Germany, France, Italy, and Great Britain is about 500,000. The Gypsies are most numerous in the Balkan Peninsula, Roumania, and Russia. In Great Britain they number between 18,000 and 40,000. Only a small number of the race are tent-gypsies, preserving the language and traditions of their race. The gypsies are now considered to have come from India, the main body of their language, though mixed with a great number of borrowed words, having a close affinity with some of the Indian languages. They first appeared in Germany in 1417, and during the fifteenth century passed through the whole of Europe. Gypsies are remarkable for the yellow-brown, or rather olive, colour of their skin, the jet-black of their hair and eyes, the extreme whiteness of their teeth, and generally for the symmetry of their limbs. The typical Gypsies rarely settle permanently anywhere, but live in tents, wandering about working in wood and iron, making domestic utensils, telling fortunes, and practising tricks. Their talent for music is remarkable, and some of their melodies have become the much-valued property of other nations, or are incorporated in some of the best-known operas. They have no peculiar religion. Amongst the Turks they are Mohammedans; and in Spain at least, as well as in Transylvania, they follow the forms of the Christian religion, without, however, caring for instruction, or having any real interest in religion. The marriage ceremony is of the simplest kind. If the husband becomes tired of his wife, he will turn her off without ceremony. There is no idea of education amongst them. The children grow up in idleness and the habits of stealing and cheating. When they first appeared in Europe, the Gypsies wandered about in hordes with a commander at their head. In the Austrian States, Maria Theresa formed the plan of converting them into orderly citizens. But her ordinances that they should dwell in settled habitations, practise some trade, and send their children to school remained to a large extent ineffectual. In England the Gypsies first appeared about the beginning of the sixteenth century, and notwithstanding severely repressive enactments on the part of the Government continued to maintain themselves as tinkers and mat- and basket-makers. In Scotland they were more favourably received, and frequently intermarried with the natives. The town of Yetholm, in Roxburghshire, was once a sort of headquarters for the race, and almost exclusively inhabited by Gypsies. Considerable numbers of the British Gypsies have emigrated to America, where they settle amongst the people and lose their distinctive characteristics. With regard to their language, a large number of the words in all the different dialects are of Indian origin, as already mentioned. The grammar of the tongue is also Oriental, and corresponds with the Indian dialects. This similarity cannot be considered the work of chance, particularly as their persons and customs show much of the Hindu character.—BIBLIOGRAPHY: George Borrow, *The Zincali, or an Account of the Gipsies in Spain*, and *Romano Lavo-Lil*; C. G. Leland, *The English Gypsies and their Language*; B. G. Smart and H. J. Crofton, *The Dialect of the English Gypsies*; F. H. Groome, *Gypsy Folk Tales*, and *In Gypsy Tents*; D. MacRitchie, *Scottish Gypsies under the Stewarts*; G. F. Black, *A Gypsy Bibliography.*

Gypsophila, a genus of Caryophyllaceæ, natives chiefly of the Mediterranean region. Several are cultivated for their flowers.

Gypsum (jip′sum), a colourless or white monoclinic mineral, chemically a hydrated calcium sulphate ($CaSO_4 \cdot 2H_2O$). Its crystallized varieties have been called *selenite*, and in a massive state it forms the rock *alabaster*. Gypsum can be scratched by the thumb-nail, which serves to distinguish alabaster from marble. At about 200° C. it gives off three-quarters of its water, and becomes a very fine white powder, extensively used under the name of plaster of Paris (q.v.). Gypsum is found in great masses near Paris, where it forms the hill of Montmartre, near Aix in Provence, and near Burgos in Spain. Gypsum is mainly a product of desiccating lakes, and occurs abundantly as beds in the Triassic strata of Northern Europe. It is even now forming, either as a deposit from water holding it in solution, or from the decomposition of iron pyrites when the sulphuric acid combines with lime, or from the action of sulphurous vapours in volcanic regions on calcareous rocks. *Anhydrite*, $CaSO_4$, sometimes arises from the dehydration of gypsum. Gypsum, pulverized by grinding or burning, has been used with good effect as a top-dressing for meadows, where it acts like powdered limestone or lime. As *land-plaster*, it is used for neutralizing the harmful sodium carbonates of ‘ alkali soils ’.

Gypsy-wort (*Lycŏpus europæus*), a labiate plant found in Britain in ditches and on river banks. It yields a dye said to be used by the Gypsies to render their skin darker.

Gyro-compass. This instrument, sometimes called the gyrostatic compass, fulfils the same purpose as the mariner's or magnetic compass, but its principle is totally different. Its action has nothing to do with magnetism, but depends on the dynamical properties of bodies in rapid rotation. The leading navies of the world are now equipped with gyro-compasses—for use in submerged submarines they are indispensable.

At the British Association meetings of 1883 and 1884 Lord Kelvin suggested methods of making a gyrostatic compass, but the first practical instrument was constructed by Anschutz about 1910. Three forms of the instrument are in use: the Anschutz (German), the Sperry (American), and the Brown (British).

General Features.—These three types have certain main features in common. The pointer, which indicates direction by the transmission of its motion to a compass-card, is the axle of a gyrostat (see *Gyroscope*) electrically driven at very high speed. When the instrument is to be used, it is set with its axle as nearly horizontal as possible, and left to itself. The axle then begins to make slow spiral converging oscillations about a certain resting position. It may be a considerable time, perhaps two or three hours, before it comes to rest. The final direction of the axle is not true north; a correction has to be made for latitude, and, on board ship, for course and speed. To apply the correction, two dials are set by hand, one to the ship's speed, and the other to the latitude; the course is allowed for automatically, and the whole correction is transmitted to the ship's head lubber-line, which is moved to port or starboard by the amount of the combined errors. The compass-card then indicates true bearings.

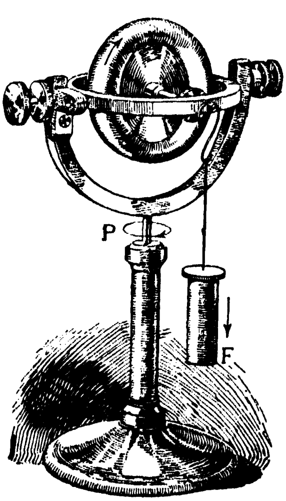


Fig. 1

Principles of Action.—The main properties of a gyrostat are: (1) directional rigidity; (2) precession. If a gyrostat is not acted on by forces tending to turn it about its centroid, then as it is carried round by the earth's rotation the direction of its axle will remain fixed in space. The axle will therefore always point to the same fixed star, and so will sweep out a right circular cone relative to its surroundings in a period of twenty-four hours, the axis of the cone being parallel to the axis of the earth. If, for example, the axle is set so as to point to the pole star, it will continue to do so, and thus act as a compass.

At sea, however, the tilted axle is impracticable, and all gyro-compasses in actual use work on the principle of precession (see *Gyroscope*), a simple case of which is illustrated in fig. 1. The weight F, hung to the end of the axle of the spinning wheel, causes the wheel with its horizontal and vertical supporting rings to turn round the vertical axis in the direction indicated at P, with constant angular speed. The gyrostat has angular momentum round its axle, and the weight tends to generate angular momentum round an axis at right angles to the axle. The result is that the axle turns uniformly round towards the axis at right angles to it, while the angular velocity of the gyrostat round its axle remains unchanged. On the same principle, in linear motion, a stone whirled round in a horizontal circle at the end of a string is acted on by a force tending to generate linear momentum in a direction at right angles to the direction of its actual momentum, and the result is that the direction of motion turns uniformly round, while the speed remains constant. An example of precession which everyone has noticed is the motion of the common spinning-top. When the top is spun in the usual way, the axis sways round the vertical, that is, precesses.

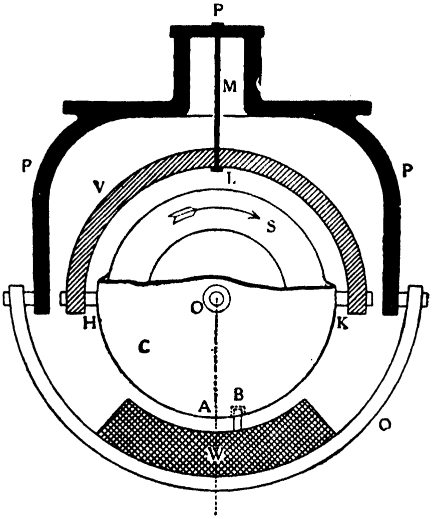


Fig. 2

Sperry Gyro-compass.—A brief description of the more essential parts of an actual instrument may be useful. Fig. 2 shows diagrammatically some of the main features of the Sperry compass. The wheel S is 12 inches in diameter, and 45 lb. in weight. It is driven at 8600 revolutions per minute. The wheel is mounted with its axle within a case C, which is supported at right angles to the axle upon the horizontal axis HK of a vertical ring V, which in turn is suspended vertically at L by means of a torsionless steel wire M of several strands, supported from the head of an outer frame P, called the 'phantom'. The phantom is electrically controlled to follow every movement in azimuth of the ring V. Suspended from the phantom is a vertical ring Q, which carries the 'bail' W, a weight which is shaped so as to swing between the vertical ring and the gyro-case, to which it is attached by a flexible pivot B, which can move in a slot in the case C, and is kept eccentrically displaced to the east of the vertical OA by means of an auxiliary gyrostat. A fixed outer frame, not shown, supports the rotating parts and accessories, and is itself carried within a gimbal ring system enclosed within a binnacle similar to those used with ordinary magnetic compasses. Suppose, now, that we are in north latitude and looking along the axle, which passes through the paper at O, in a direction inclined, say, a little to the east of north. The wheel is rotating in the same direction as the earth, which is essential. Owing to the earth's rotation, the north end of the axle begins to tilt upwards, so that the pivot B is displaced to a position where it is effective for causing precessional motion of the axle, which describes a spiral cone the trace of which, ENWSFGH on a vertical east-and-west plane, is represented in fig. 3.

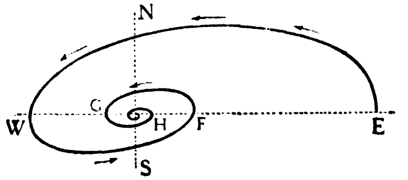


Fig. 3

It will be seen that the axle comes practically to a resting position after about three revolutions. For a given design of compass the period of revolution (the time from E to F, for example) is controlled by the gyro speed and the weight of the bail. These are adjusted so as to make the period about 85 minutes, as it is proved by calculation that with this period temporary oscillations due to sudden changes of speed or course are reduced to a minimum.

Mention should be made of a very troublesome fault common to all gyro-compasses, called the quadrantal error. This error does not arise if the ship is steaming north, south, east, or west, but on any other course, when the ship rolls, the rotating wheel tends to set itself with its rim in line with the roll. Unlike the errors depending on speed, course, and latitude, the quadrantal error cannot be dealt with as it occurs, and on this account has had more to do with the changes of design in the later forms of compass than any other factor.—BIBLIOGRAPHY: T. W. Chalmers, *The Gyroscopic Compass*; The Sperry Gyroscope Company, Ltd., 15 Victoria St., London, S.W., *Elementary Theory and Brief Description of the Sperry Gyro-compass*; S. G. Brown, *The Gyrostatic Compass* (articles in *Nature*, 11th and 18th March, 1920).

Gyroscope and Gyrostat, scientific forms of spinning top, by which the laws of rotational motion are illustrated or turned to practical use. In the gyroscope, the rotating wheel is exposed to view, and usually one point on the axis is fixed; in the gyrostat, as designed by Lord Kelvin, the wheel is concealed within a closed case. In practice, however, the two names are used almost indifferently. The essential part of the instrument is the fly-wheel, which is generally a disc with a massive rim, and may be mounted in various ways. Fig. 1 of the article *Gyro-compass* shows one arrangement, in which the axis of the wheel is held by a ring resting on bearings, so that the ring can turn about an axis perpendicular to the axis of the wheel. These bearings are at the upper end of an upright fork, which with its stem (at P) is free to turn in a vertical socket. The wheel with its ring may be detached from the fork, and the end of the axle supported on a pivot, or by a string. The main principles on which the action of a gyrostat depends have been briefly explained in the preceding article. Most people find it difficult to see why the weight F in fig. 1 should move to the side instead of down. In ordinary cases, when a force is applied to a body, the point of application moves in the direction of the force. In this case, it is not the direction of the applied force which counts, but the plane of the applied torque. Before the weight F is attached, the gyrostat has an angular momentum $I\omega$ about its axis, I being its moment of inertia, and ω its angular velocity. The weight F produces a torque or couple C about the horizontal axis at right angles to the axis of rotation. This torque generates angular momentum Ct about the axis of the torque in the small time t. The resultant angular momentum after time t is found by the usual parallelogram construction. The axis of resultant angular momentum therefore turns through a small angle $Ct/I\omega$ in time t. This axis is very approximately simply the axis of rotation of the wheel, which therefore turns round in the horizontal plane with angular velocity ω', where $\omega' = C/I\omega$, or $I\omega\omega' = C$. It also follows that the direction of the precession is as indicated at P in fig. 1. The small increase of angular momentum, being $\sqrt{I^2\omega^2 + C^2t^2} - I\omega$, is proportional to t^2; the angular momentum will therefore remain constant, its rate of increase being zero. Most ordinary examples of gyrostatic action are readily understood by comparing them with the above simple case. It is easy to see, e.g., that pushing the weight F against the motion will raise F, but that pushing it so as to help the precession will bring it down: compare the method of steering a bicycle. When a motor-car turns a corner, the axles of the wheels are turned round in a horizontal plane; hence a torque in a vertical plane is required, which is supplied by the easing of the pressure of the inner wheels on the ground. The action of the *gyrostatic couple* (see *Centrifugal Force*), which is produced when a carriage turns a corner, tends therefore to turn the carriage over towards the outside of the curve. In an aeroplane, the propeller and the rotor of the engine form a powerful gyrostat. When the aeroplane is turned in a horizontal plane, it tends to dive or to rear, according to the direction of turning. The *Schlick controller* is a gyrostatic device for steadying a ship at sea. When the ship is on an even keel, the axis of the gyrostat is kept vertical by means of a heavy weight. Heeling makes the gyrostat precess, and couples resisting the rolling are brought to bear on the ship. In trials it was found that the angle of roll was under 1° in a cross-sea which produced a swing of 35° when the gyrostat was out of action. A projectile shot from a rifled gun is a gyrostat which tends to preserve the direction of the axis of rotation. Torpedoes are kept in a straight course by the action of a gyrostat. In the mono-rail, a car balanced by gyrostats is carried on a single row of wheels, but no satisfactory method has so far been devised for enabling the car to turn a corner safely.—BIBLIOGRAPHY: Kelvin and Tait, *Natural Philosophy*; A. Gray, *A Treatise on Gyrostatics and Rotational Motion*; H. Crabtree, *Spinning Tops and Gyroscopic Motion*.

Gyula (dyö′lå), a market town of Hungary, on the Körös. It consists of two distinct villages, Magyar and Nemet (German), on opposite sides of the river. Pop. 24,284.

H

H, the eighth letter of the English alphabet, often called the *aspirate*, as being a mere aspiration or breathing, though not the only aspirated letter in English. The sound that distinctively belongs to it is that which it has at the beginning of a syllable before a vowel, as in *hard, heavy*. It is very commonly joined to other consonants to represent sounds for which there are no special letters in the alphabet, as in the digraphs *ch, sh, th* (*child, ship, thin, this*), or in other consonantal combinations of various origins and values, as in the words *enough* (*gh*=*f*), *plough* (*gh* silent), *philosophy* (*ph*=*f*), *rhetoric* (*h* silent), &c. *Ch* is common in words taken from the Greek, but in this case it generally has the *k* sound, as in *chemistry, chyle, logomachy*, &c. See *Grimm's Law*.

Haakon VII, King of Norway, born 3rd Aug., 1872. The second son of King Frederick VIII of Denmark, he was elected in 1905 King of Norway on the separation of this country from Sweden. In 1896 he married Princess Maud, youngest daughter of King Edward VII. He was baptized Charles, but on his election as King of Norway he assumed the name of Haakon, and gave to his son, born in 1903, the name of Olaf.

Haarlem (här′lem), a town of Holland, province of North Holland, 10 miles w. of Amsterdam, intersected by the Spaarne, which is joined by canals from Leyden and Amsterdam, and along which a considerable traffic is maintained. The town is well and regularly built; the streets exceedingly clean, planted with trees and laid out in promenades. Amongst the notable buildings are the town hall, the church of St. Bavon with its celebrated organ (built in 1735), the Prinsenhof, in which the Provincial Assembly meets. The manufactures of Haarlem, as well as its population, are less than what they were formerly; but it has still various industrial works, a celebrated type-foundry, the oldest and most famous printing-office in Holland, and its flower trade, especially in hyacinths and other bulbs, is very important. On the south side of the town is the park of Haarlem, a plantation of fine old beeches surrounded by villas, cafés, and places of holiday resort. Haarlem was a prosperous place as far back as the twelfth century. During the revolt of the Netherlands it sustained a famous seven months' siege by the Spaniards. It is the birth-place of Laurence Coster, supposed inventor of movable types, and of a number of painters, Ostade, the Wouvermans, Ruysdael, and Van Loo. Pop. (1920), 77,302.

Haarlem, Lake of, a former lake of Holland, adjoining and communicating with the Y, between Haarlem and Amsterdam. Previously a swamp, it was formed in the fifteenth century by the overflow of the Rhine and the crumbling away of the banks of the Y, and imperilled by its growth the towns of Haarlem, Amsterdam, and Leyden. It was 18 miles long, 9 miles broad, and about 14 feet deep. The draining of it was commenced in 1840, and completed in 1853. The soil thus reclaimed, known as the Haarlemmer Polder, now forms a commune, which numbers about 20,000 inhabitants.

Haase, Hugo, German Socialist leader, of Jewish extraction, born at Allenstein, Prussia, in 1863, died in 1919. He studied law at Königsberg, and in 1897 entered the Reichstag, where he became one of the leaders of the Socialist party and succeeded Bebel as president of the Social Democratic party. In 1915 he formed an Independent Socialist party, which refused to vote the war credits. He took an active part in the revolution of Nov., 1918, was shot on 8th Oct., 1919, by an Austrian named Johann Voss, and died four weeks afterwards.

Habak'kuk, the eighth of the twelve minor prophets. He flourished about 600 B.C. at the time of the invasion of Judah by the Chaldeans, against whom he prophesies God's retributive justice. He concludes with a kind of psalm (chap. iii) remarkable for the majesty of its language and the sublimity of its thought.

Habeas Corpus (Lat., 'that you have the body'), one of the most ancient and celebrated writs of English law. It has various forms, but that of paramount importance is the writ 'Habeas corpus ad subjiciendum'. This writ, issued by the High Court, is directed to any party unjustly detaining another in custody, and requires that 'the body' of the prisoner be produced and the cause of the detention stated. It is granted at the suit of the prisoner himself or other party. It is the great safeguard of personal liberty, and is as old as Magna Charta, but its constant evasion by weak and servile judges under the Stuart kings led to the strengthening of the law by the passing of the Habeas Corpus Act, 1679.—Cf. Hallam's *Constitutional History*.

Habit and Repute, in Scots law, an expression applied to denote something so notorious that it is taken without further proof to be true. Thus, marriage may be established by habit and repute, where the parties cohabit and are recognized by the neighbours as man and wife. Also if a person is by habit and repute a thief, that is, a notorious thief, the punishment inflicted is heavier.

Habitual Criminals Act, a British Act passed in 1869 (32 and 33 Vict. cap. xcix) to make further provision for the suppression of crimes. This statute was, however, repealed two years after by a more comprehensive Act known as the Prevention of Crimes Act. The Act of that title passed in 1908 applies the term 'habitual criminal' to one who has been at least three times convicted of crime since attaining sixteen years of age and who is leading a life of habitual dishonesty or crime. See *Prevention of Crimes Act.*

Habsburg (properly **Habichtsburg**, the hawk's castle), a small place in the Swiss canton of Aargau, on the right bank of the Aar. The castle was built about 1027 by Bishop Werner of Strasbourg. Werner II, who died in 1096, is said to have been the first to assume the title of Count of Habsburg. After the death, about 1232, of Rudolph II, the family divided into two branches, the founder of one of which was Albert IV. In 1273 Rudolph, son of Albert IV, was chosen Emperor of Germany, and from him descended the series of Austrian monarchs, all of the Habsburg male line, down to Charles VI inclusive. After that the dynasty, by the marriage of Maria Theresa to Francis Stephen of Lorraine, became the Habsburg-Lorraine. Francis II, the third of this line, was the last of the so-called 'Holy Roman Emperors', this old title being changed by him for that of Emperor of Austria. From the Emperor Rudolph was also descended a Spanish dynasty which began with the Emperor Charles V (Charles I of Spain), and terminated with Charles II in 1700. The Habsburgs ruled in Austria-Hungary until 1918, when, in consequence of the Revolution, Charles, a grand-nephew of Emperor Francis-Joseph, lost the throne. The castle of Habsburg is still to be seen on the Wülpelsberg.—BIBLIOGRAPHY: H. W. Stead, *The Habsburg Monarchy*; J. Gilbart-Smith, *The Cradle of the Habsburgs.*

Hackberry, the popular name of the North American varieties of the nettle-tree (*Celtis crassifolia*), also of the *Celtis occidentalis*, belonging to the nettle family Urticaceæ. See *Nettle-tree.*

Hackländer (hak'len-dėr), Friedrich Wilhelm von, a German novelist and comedy writer, born in 1816, died in 1877. He engaged first in commerce, then entered the Prussian artillery, and commenced his literary career in 1841 with *Pictures from a Soldier's Life in Time of Peace.* He then became successively private secretary to Baron Taubenheim, whom he accompanied to the East, and to the Crown Prince of Würtemberg. In 1849 he served with the Austrians during the war with Sardinia, and published his *Pictures from a Soldier's Life in Time of War.* He was ennobled by the Emperor Francis Joseph. Amongst his many writings distinguished by a mixture of pathos and humour we may mention *Daguerreotypen* (1842), *Handel und Wandel* (1850), *Der Neue Don Quixote* (1858), *Geschichten im Zickzack* (1871); of his comedies, *Der Geheime Agent* (1850) was the most successful.

Hackney, a municipal and parliamentary borough of London, 3 miles N.N.E. of St. Paul's. It includes Hackney proper, South Hackney, &c., and is still a favourite residence of wealthy merchants. It returns three members to Parliament. Pop. 222,159.

Hackney Coach, a coach let out for hire. Hackney coaches began first to ply under this name in London in 1625, when they were twenty in number. Hackney coachmen were generally put under police regulations, and a tariff of fares imposed upon them. Cabs were the common kind of hackney coaches until superseded by taxi-cabs.

Haddington, a royal (formerly a parliamentary) burgh of Scotland, capital of the county of same name, 17 miles east by north of Edinburgh, on the Tyne. The town is neatly built, and has a town-house, a fine structure; handsome county buildings; a Gothic church of the eleventh or twelfth century, the nave of which forms the parish church; &c. Its grain-market is one of the largest in Scotland. Prior to 1885 it united with North Berwick, Dunbar, Lauder, and Jedburgh in sending a member to the House of Commons. Pop. 4053.

Haddington, the county, also called **East Lothian,** is bounded by the Firth of Forth, the North Sea, Berwickshire, and Midlothian; area, 280 sq. miles, of which four-fifths is arable or fit for cultivation. The surface rises gently from the coast towards the Lammermuir Hills, 500 to 1700 feet high, which form its south boundary. It is divided into two nearly equal portions by the River Tyne. The minerals include coal, limestone, ironstone, and sandstone; the coal is worked. Haddingtonshire has been long celebrated for the skill and success with which its husbandry has been conducted. The low lands of the north and the west are very fertile, while the high lands adjoining the Lammermuir Hills supply excellent pasturage for sheep. Fishing and fish-curing are carried on at Dunbar and other points. The county unites with Berwick in returning one member to Parliament. Pop. 47,487.

Haddock, a well-known fish of the cod family (Gadidæ), *Gadus æglefinus.* It is smaller than the cod, which it much resembles, but it has a dark spot on each side of the body just behind the head. This fish commonly weighs from 2 to 6 lb., though sometimes as much as 10 lb. It breeds in immense numbers in the northern seas, is caught by lines and trawl-nets, and is a valuable source of food. In Scotland haddocks are commonly cured by smoking over a wood fire.

Hadersle'ben, a town of Prussia, in Schleswig-Holstein, on the Hadersleben Fiord, in the Little Belt. Pop. 13,046.

Hades (hā'dēz), originally the Greek name of the lord of the lower or invisible world, afterwards called Pluto; but in later times, as in the Greek Scriptures, it is applied to the region itself. According to the belief of the ancients, the departed spirits of good and bad alike went to the halls of Hades.

Hadj, the Mohammedan pilgrimage to Mecca, which every Mohammedan ought to perform once in his life, and after which he is entitled to prefix *Hadji* to his name. The pilgrimage has been made in disguise by Burckhardt in 1814, by Burton in 1853, by T. F. Keane in 1878, by Snouck-Hurgronje in 1884, and by A. J. B. Wavell in 1911.

Hadji Khalifah, the surname of Mustapha-Ben-Abdallah, a Turkish historian, born at Constantinople about 1605; became 'first secretary' to Sultan Mourad IV; and died at Constantinople in 1658. His most important work is *Keshf-ul-tzunûn*, a kind of encyclopædia of Arabic, Turkish, and Persian literature. Among his other works are: *Chronological Tables, Mirror of the World,* and *History of the Maritime Wars of the Turks.* All the works mentioned have been translated into Latin or modern languages.

Hadleigh, an old market town of England, Suffolk, 10 miles west of Ipswich, formerly one of the chief seats of the woollen manufacture introduced by the Flemings, and still possessing some interesting old houses. Pop. 3038.

Hadley, John, English astronomer, born towards the end of the seventeenth century, died in 1744. He is the reputed inventor of the quadrant that goes by his name, though the honour is also claimed for Newton, from whom Hadley got a description of the instrument in 1727, and for Thomas Godfrey of Philadelphia, who produced his instrument about the same time as Hadley in 1731. The Royal Society decided that Godfrey and Hadley were both entitled to the honour of the invention. Hadley also invented the sextant.

Hadramaut, a district of Arabia which, in the older and wider use of the term, extended from Yemen on the west to Oman on the east, and from the Indian Ocean on the south to the great desert of El Ahkaf on the north. The name is, however, generally confined by the natives to a much smaller tract in the south-west. There are some fertile valleys and glens, one of the most important being that of the Wadi-Doan, where the slopes of the mountains are covered with towns and villages, and grain crops, dates, indigo, bananas, &c., are extensively cultivated. On the coast Makallah is the chief commercial depot.

Ha'drian, in full, *Publius Ælius Hadrianus,* the fourteenth in the series of Roman emperors, born at Rome 24th Jan., A.D. 76. His father, who was cousin to the emperor Trajan, died when Hadrian was ten years old, and left him under the charge of his illustrious kinsman. He married Sabina, Trajan's grand-niece, accompanied the emperor on his expeditions, filled the highest offices of State, and, on the death of Trajan, assumed the government as his adopted son (117). He made peace with the Parthians, renouncing all conquests east of the Euphrates, and bought off a war with the Roxolani by payment of a sum of money. From the year 121 he spent most of his time in visiting the various provinces of the empire. Hadrian's policy was a peaceful one, because he saw that the further extension of the empire only weakened it. Although avoiding war as much as he could, he kept the armies in excellent condition, fortified the frontiers in Germany, and, crossing over into Britain, constructed the wall known as Hadrian's Wall (or that of Severus), which protected the Roman province from the barbarous tribes of the north. He next travelled into Asia and Africa, and lived in Athens for three years. In 131 he promulgated the *Edictum Perpetuum*, a fixed code of laws, which forms an important epoch in the development of Roman law. In 132 the Jews revolted, and for four years carried on a bloody war, the only notable one of his long reign. Hadrian died at Baiæ in 138.—BIBLIOGRAPHY: F. Gregorovius, *The Emperor Hadrian*; Aelius Spartianus, *The Life of the Emperor Hadrian*; J. B. Bury, *The Student's Roman Empire*.

Roman Coin showing the Emperor Hadrian

Hadrian's Wall. See *Roman Roads and Walls.*

Hadrosaurus (Gr. *hadros*, thick, and *sauros*, lizard), a genus of large extinct reptiles, remains of which have been found in the Upper Cretaceous strata of the United States, and in England. It appears to have resembled the gigantic iguanodon of Europe in its size, herbivorous habits, and anatomical structure.

Haeckel (hek'l), Ernst, German scientist and natural philosopher, born at Potsdam in 1834, died in 1919. He studied medicine and science at Berlin, Würzburg, and Vienna; travelled in Norway and Italy; and became professor of zoology at Jena in 1865. Later he visited Syria, Egypt, Algeria, Ceylon, &c., to perfect his knowledge of natural forms. He was the most prominent exponent of the Darwinian theories in Germany. Among his works are to be found: *The Radiolariæ* (1862), *The History of Creation* (1868), *Anthropology* (1874), *History of the Evolution of Man* (1875), *Collected Popular Discourses on the Development Theory* (1878–9), and *The Riddle of the Universe* (1900—very widely sold). Haeckel was one of the ninety-three German intellectuals who signed the famous manifesto at the beginning of the European War, wherein they defended Germany's action.

Hæmal Cavity, in anatomy, a term applied to the cavity which contains the great centres of circulation in the Vertebrata, together with the digestive and respiratory apparatus. The *Hæmal Arch* is the arch formed by the projections anteriorly of the ribs and the sternum from the vertebræ.

Hæmanthus, the blood-flower, a genus of South African bulbous plants.

Hæ'matin, or Hematine is a brown pigment found in the hæmoglobin of the red blood corpuscles. Its composition has not been definitely made out, but it is one of the few substances in the body that contain iron.

Hæ'matite, Red and Brown. See *Hematite*; *Iron.*

Hæmat'opus, a genus of plover-like birds, the best-known species of which is *H. ostralĕgus*, or common oyster-catcher, sea-pie, or mussel-picker. This has a wide range in the Old World. Related species inhabit America, Australia, and New Zealand.

Hæmatox'ylin ($C_{16}H_{14}O_6$), the colouring-matter of logwood, or *Hæmatoxylon campechianum.* This colouring-matter is a constituent part of all the colours prepared with logwood, and the changes which it undergoes by the action of acids and alkalies render it useful as a reagent to detect their presence.

Hæmatozo'a (Gr. *haima*, blood, and *zōon*, an animal), a name given to the parasitic animals which, under certain conditions, exist in the blood of mammals, birds, reptiles, fishes, and many invertebrate animals. They are generally microscopic, and some of them are connected with various diseases.

Hæmatu'ria (Gr. *haima*, blood, and *ouron*, urine) is blood in the urine, usually arising from disease of the kidneys or bladder. Endemic hæmaturia occurs in Egypt as a result of the action of a blood parasite in the disease known as bilharziosis.

Hæmog'lobin, or Hæmoglob'ulin, the semi-fluid or quite fluid matter of a red colour contained in the red corpuscles of the blood. It can be resolved into an albuminous substance called globulin and the colouring-matter hæmatin.

Hæmop'tysis (Gr. *haima*, blood, and *ptysis*, a spitting), the coughing up of blood, sometimes produced by fullness of the blood-vessels of the lungs or throat, or by the rupture of blood-vessels as a consequence of ulceration. It is distinguished from blood coming from the stomach by the comparative smallness of its quantity, and by its usually florid colour. It may occur in heart disease, in pneumonia, and is one of the serious signs of progressive tubercular disease of the lungs (phthisis). In women it is sometimes a case of vicarious menstruation.

Hæmorrhage. See *Hemorrhage.*

Hafiz, Mohammed Shems-ed-dîn, one of the most celebrated and most charming poets of Persia, was born at Shiraz in the beginning of the fourteenth century, died there about 1390. He studied theology and law, sciences which, in Mohammedan countries, are intimately connected with each other. He preferred independent poverty as a dervish to a life at court, whither he was often invited by Sultan Ahmed, who earnestly pressed him to visit Bagdad. His poems, known collectively as the *Divan*, are Anacreontic in sentiment, abounding in the praise of love and wine. An English translation of the *Divan*, by H. W. Clarke, appeared in 1891.

Hag, the name of the fish-like vertebrates of the genera Myxîne and Bdellostoma, that, with the allied lampreys, constitute the class Cyclostomata, which are lower in the scale than fishes, though they are sometimes included in the latter as a distinct order (Marsipobranchii). They are of eel-like form, and have no eyes, limbs, or scales; the mouth is formed for suction, is without a lower jaw, and furnished with fleshy filaments or barbels. There is a single fang upon the palate and other horny teeth by which the hag eats its way into the interior of other fishes, such as the cod, ling, or haddock. *Myxîne glutinōsa*, the common hag, is found in the British seas, and is about 12 or 15 inches long.

Hagen (hä′gėn), a manufacturing town of Prussia, in Westphalia, at the confluence of the Volme and Ennepe. It has iron- and steel-works, and manufactures of metal goods and textiles. Pop. (1920), 92,862.

Hagenau (hä′gė-nou), a town of France, Alsace-Lorraine, 18 miles N. of Strasbourg, on the Moder. It has some manufactures, and is a centre of hop culture. Pop. 18,860.

Hagerstown, a town, United States, Maryland, 6 miles north of the Potomac River. Pop. (1920), 28,029.

Haggai (hag′ā-ī), the tenth in order of the minor prophets, and first of those who prophesied after the captivity. The book of Haggai consists of four distinct prophetical addresses—two in the first and two in the second chapter—intended to rouse his disheartened countrymen to the rebuilding of the temple.

Haggard, Sir Henry Rider, English novelist, born in 1856, son of a Norfolk landed proprietor, became secretary to Sir Henry Bulwer, Governor of Natal, in 1875, and held various other appointments in South Africa, including the mastership of the high court of the Transvaal; but since 1879 has mainly resided in England, being called to the Bar in 1884. He has made Africa the scene of some of his novels, and his pictures of life and fighting among Kaffirs and other South African peoples are often more highly coloured than artistic. His first book was *Cetewayo and his White Neighbours* (1882), but he became much better known by his *King Solomon's Mines* (1886), and still more by his romantic *She* (1887), which have been followed by *Allan Quatermain*; *Jess*; *Maiwa's Revenge*; *Mr. Meeson's Will*; *Colonel Quaritch, V.C.*; *Cleopatra*; *Eric Brighteyes*; *Nada the Lily*; *Montezuma's Daughter*; *Joan Haste*; *Swallow: a Story of the Great Trek*; *Pearl-Maiden*; *Ayesha* (a continuation of *She*); *Red Eve*; *When the World Shook*; and *The Ancient Allan*. His tales are strong in incident and adventure, but weak in character-drawing. Haggard greatly interested himself in the agriculture and rural industries of England, and made personal investigations by travel and otherwise, the results being the works *Rural England* (1902), *The Poor and the Land* (1905), and *Rural Denmark* (1911). He was knighted in 1912, and created K.B.E. in 1919. An elder brother, Andrew Charles Parker (born 1854), entered the army, and rose to the rank of lieutenant-colonel, after a distinguished career, especially in Egypt. He has also written novels, as well as poetry, and articles on sport. He died in 1925.

Hagiology. See *Acta Sanctorum*; *Canonization*; *Saint*.

Hague, The (hāg; Du. *'S Gravenhage*—the Count's Hedge; Fr. *La Haye*), the third largest town in Holland, practically, though not formally, the capital of the Netherlands, is in the province of South Holland, 33 miles south-west of Amsterdam, and within 3 miles of the sea. It is the residence of the sovereign and of the foreign ambassadors, and the seat of the States-General of the Netherlands and of the chief part of the central administration. It is pleasantly situated, and is distinguished for width and straightness of streets, and general stateliness of public buildings. Near the centre is a fine sheet of water—the Vijver—surrounded by important buildings. Among the chief structures are the royal palace, the palace of the queen mother, the Binnenhof, a large irregular building, founded in 1249, and containing the hall of assembly of the States-General, and various Government offices; the provincial Government house, a large roomy edifice, the town hall, royal library (500,000 vols.), high court of justice; the Groote Kerk, or church of St. James, with hexagonal tower and finely vaulted interior; and the Mauritshuis, built by Prince John Maurice of Nassau, now converted into a picture gallery, containing some of the finest works of the Dutch masters. The Palace of Peace, built at the expense of Andrew Carnegie, was opened in Aug., 1913. There are some manufactures—furniture, pottery, gold and silver wares, hats, &c.—but the town mostly depends on the presence of the court and the number of strangers that come for sea-bathing to Scheveningen, about 3 miles distant. The

Hague took its origin in a hunting-seat of the Counts of Holland in 1250, and became the political capital of the states in the sixteenth century, but it has grown to be a place of real importance chiefly since the beginning of the nineteenth century. An international conference (the 'Hague Conference') was held here in 1899, at the suggestion of Tsar Nicholas II, and questions regarding the reduction of armaments, the use of inhuman practices in warfare, &c., were discussed, but the chief outcome was the establishment of a permanent court of arbitration, before which disputes among the different powers may be brought for peaceful settlement. Another conference was held at the Hague in 1907. In 1920 it was proposed to make The Hague the seat of the League of Nations, but Geneva was finally selected. Pop. (1920), 359,610.

Haguenau. See *Hagenau.*

Hahnemann (hä'nė-män), Samuel Christian Friedrich, the founder of the homœopathic system, born at Meissen in 1755, died in Paris in 1843. He studied medicine at Leipzig, Vienna, and Erlangen, taking his degree at the last-mentioned place in 1779. After practising in various places, he published in 1810 his *Organon der rationellen Heilkunde*, which fully explained his new system of curing any disorder by employing a medicine which produces a similar disorder. (See *Homœopathy.*) Hahnemann was driven from Saxony by the Government prohibiting him from dispensing medicines, but found an asylum ultimately in Paris, where his system was authorized by the Government and acquired a certain popularity. Among his works are a *Dictionary of Materia Medica, Essay on Poisoning by Arsenic, On the Effects of Coffee*, and his treatise *On Chronic Affections.*

Hahn-Hahn, Ida, Countess of, German authoress, born in 1805, died in 1880. She was the daughter of Count Karl Friedrich of Hahn-Hahn, who squandered most of his means as an entrepreneur of dramatic companies. In 1826 she married a wealthy cousin, but three years later was divorced, after which she travelled extensively in Italy, Spain, and the Levant. In 1835 she made her debut in literature with *Poems*, followed by *Venetian Nights* (1836), *Songs and Poems* (1837). But her popularity is chiefly founded on her novels, especially those of social life, amongst which *Aus der Gesellschaft* (1838), *Gräfin Faustine* (1841), and *Sigismund Forster* (1843) may be mentioned.

Haiducks, or **Haiduks** (Hun. *Hajduk*, drovers), a term originally applied to certain herdsmen of Hungary who refused to submit to Turkish rule and found an asylum in the Eastern Hungarian mountains, where they were regarded as patriotic heroes. Afterwards the name was applied to the bands of Magyar foot soldiers who placed themselves at the service of any potentate who was willing and able to pay them. Their fidelity to the cause of Bocskai, Prince of Hungary, in the War of Succession was rewarded by a grant from that prince, in 1605, of a separate district of the country for their residence, with privileges of nobility, &c., which they continued to enjoy till 1848. In Poland and Hungary the term Haiduks is also applied to the servants of great houses.

Haifa, a seaport of Palestine, on the south side of the Bay of Acre, at the foot of Mt. Carmel; starting-point of a railway to Damascus. Haifa was occupied by the British on 23rd Sept., 1918. Pop. 20,000.

Haig, Douglas Haig, first Earl, British soldier, Knight of the Thistle, Knight Grand Cross of the Bath, Order of Merit, Knight Grand Cross of the Victorian Order, Knight Commander of the Order of the Indian Empire, was born on 19th June, 1861, the son of J. Haig, Esq., J.P., of Cameronbridge, Fifeshire. He was educated at Clifton and Brazenose College, Oxford, and in 1885 was gazetted to the 7th Hussars. In 1891 he was promoted captain, received a brevet majority in 1898, became a substantive major in the following year, received a brevet lieutenant-coloneley in 1900, and was appointed to the command of the 17th Lancers with the substantive rank of lieutenant-colonel on the 16th July, 1901.

As a captain he went to the Staff College at Camberley, and in 1898 was serving with the Egyptian army in the Sudan. From Egypt he returned to England for a brief spell of duty as brigade major of the Aldershot Cavalry Brigade, from which, on the first hint of trouble in South Africa, he received promotion to the appointment of Deputy Assistant Adjutant-General in South Africa. From this time onward he never looked back, and, with the exception of a few years as regimental lieutenant-colonel (17th Lancers), his subsequent service has been on the Staff. From Deputy Assistant Adjutant-General he became Assistant Adjutant-General in South Africa, and acted in other important positions till July, 1901, when he went to the 17th Lancers. After the conclusion of peace with the Boers, Haig was sent to India as Inspector-General of Cavalry (1903–6), after which he returned to England and was employed at the War Office first as Director of Military Training and later as Director of Staff Duties, where he had much to do with the creation of the General Staff. In 1909 he accepted the appointment of Chief of the Staff, Army Head-quarters, India, which he held until Feb., 1912. In that year he was ordered to England to take up the important appointment of Commander-in-Chief, Aldershot Command, which he was still holding when the European

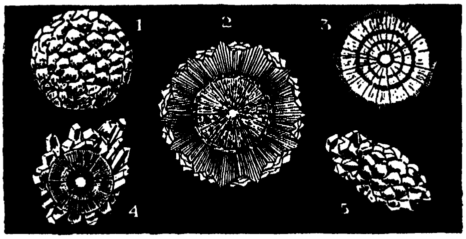
War broke out. While Chief of Staff in India, Haig had been promoted lieutenant-general (31st Oct., 1910)—he had been a major-general since 1904—and in Aug., 1914, he stepped naturally into the position of Commander of the 1st Army Corps of the British Expeditionary Force. In November of the same year he was promoted to full General, and when in Dec., 1915, Sir J. French resigned the Chief Command of the British armies in France, it was Sir Douglas Haig, a full General of only twenty-nine years' service and in his fifty-fifth year of age, who was selected by the Cabinet to succeed him in his difficult post.

By this time the army in France was growing daily both in personnel and material: fed in the one case by battalions and divisions of the New Army, and in the other by the war material provided by the Ministry of Munitions (formed in June, 1915). Vol. iii of the *Chronology of the War* gives some interesting figures showing how the supply of munitions increased after the formation of the Ministry, and from this we take the following as an example. In the third quarter of 1915, i.e. just after the Ministry had been formed, the output of guns—light, medium and heavy — was 1118, and of rounds of artillery ammunition, 2,083,000. In the third quarter of 1918 the output under the same headings was 3064 guns and 15,780,000 rounds. In Dec., 1915, in spite of the fact that men and munitions were arriving in increasing numbers, Haig refused to be stampeded into an attack until he was ready and was quite certain that his new divisions had been sufficiently initiated into the practical part of modern soldiering to permit them to take part in a general attack. With this end in view he, so to speak, marked time, during which period his battalions were being trained and his reserves of munitions were piling up. A reference to p. 108 of vol. ii of the *Chronology of the War* will show that the British army in France took the initiative in no main events till 1st July, 1916, on which date began the great combined Franco-British offensive on the Somme. These operations, though they did not perhaps produce the far-reaching effects expected, were nevertheless of great value, and, beyond the actual tangible gains, the experience obtained enabled General Head-quarters to make further improvements and adjustments in the still-growing British Expeditionary Force; and to such an extent were the lessons learnt and acted upon that towards the end of 1917 a writer in the *National Review* says: "Profiting by the situation which Haig and his men have created, the French have been able to deal a tremendous blow near Verdun in that dramatic fashion of theirs. . . . Vienna had to pray in vain for troops to meet Cadorna's devastating strokes. . . . The great General Staff in Berlin had been unable to overwhelm the Roumanian army. . . . For four months Haig has been calling the tune . . . and we are bound to acknowledge that it is in no small degree due to the grit and abilities of the Commander-in-Chief himself that the military resources of the empire occupy the centre of the stage at the beginning of the fourth year of the world-wide conflict."

On 1st Jan., 1917, Sir Douglas Haig was promoted Field-Marshal, and on 14th July of the same year he was created a Knight of the Thistle. The great German attack of the early part of 1918 was the occasion on which the Field-Marshal issued his stirring Order of the Day (13th April) in which occur the very human words: "Many of us are now tired. . . . Victory belongs to the side which holds out longest. . . ." On 13th March, 1919, Haig was appointed to the Command of the Forces at Home, which he retained till General Head-quarters of Great Britain ceased to exist with the official end of the war in the following year. On 6th Aug., 1919, in recognition of his great services, he was created an Earl.

Since the end of the war Earl Haig has made the cause of the ex-service men his own, and has spared neither time nor trouble in his endeavours to obtain fair treatment for them—both from the Government and from employers of labour. Earl Haig's principal Dispatches were published in London as follows: 1916—30th May, 12th Dec.; 1918—1st Jan., 20th Feb., 16th April, 23rd April, 21st Oct.; 1919—1st Jan., 11th April.—Cf. Lieutenant-Colonel J. H. Boraston (editor), *Despatches 1915–1919*.

Hail, small masses of ice or frozen rain falling from the clouds in showers or storms, varying in their form, being either angular, pyramidal, or stellated, as well as in their consistency, being sometimes as hard as ice and sometimes as soft as snow. At the centre there is generally an opaque spongy mass, resembling sleet in its composition, and round this a semi-transparent congealed mass, consisting of a succession of layers or strata, is formed. Properly there are



Hail

1, Soft hail. 2, 3, Sections of hailstones. 4, 5, Remarkable types of crystalline form.

two kinds of hail—the small grains which generally fall in winter and usually before snow; and the large hail which occurs chiefly in spring and summer, and is most severe in very hot climates. The small-grained hail is probably formed by the freezing of rain-drops as they pass in falling through colder air than that from which they started. The large or common hail is probably due to the meeting of two currents of air, of very unequal temperature and electric tension. The usual size of hailstones is about ¼ inch in diameter, but they are frequently of much larger dimensions, sometimes even 3 or 4 inches in diameter. In hot climates they are very destructive to crops.

Hailes, Lord. See *Dalrymple, Sir David.*

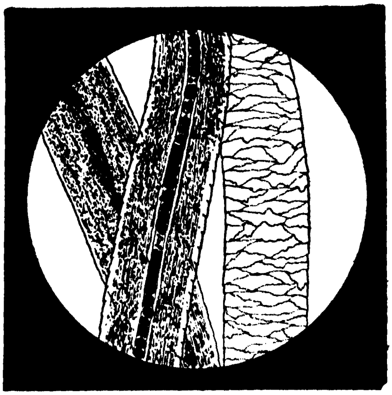
Hainan, an island of China, belonging to the province of Quang-Tung, between the China Sea and the Gulf of Tonquin, and separated from the mainland by a channel of 15 miles, encumbered with shoals and coral reefs. It is almost oval in shape, and has an area of nearly 14,000 sq. miles. The fertile lowlands on the northern and western coasts are occupied by immigrant Chinese, to the number of about 1,500,000, who cultivate rice, sugar, tobacco, &c. The fisheries are also productive. The interior, which is mountainous and covered with forests, is inhabited by a distinct race still in a very primitive stage. The capital is Kiung-chow, on the northern coast, a large seaport.

Hainaut, or **Hainault** (ā-nō; Du. *Hennegowen*; Ger. *Hennegau*), province of Belgium, bounded on the south and west by France; area, 1437 sq. miles. Though nowhere properly mountainous, it is very hilly in the south-east, where it is covered by the Western Ardennes. In other directions it is generally flat, though well diversified. About three-fourths of the whole surface is arable, and scarcely a hundredth part is waste. The soil is generally fertile, and there are extensive coal-fields, coal, together with flax, linen, hemp, tobacco, and porcelain being the chief articles of export. Manufactures, chiefly cutlery, woollen and linen goods, &c., are carried on to a great extent. The capital is Mons. Estimated pop. in 1920, 1,215,000. The old province of Hainault, in Cæsar's time the native district of the Nervii, was in the tenth century governed by a race of counts, the succession of which continued unbroken till 1436, when Jacqueline, heiress of William IV, was forced to cede her lands to Philip, Duke of Burgundy. With Mary of Burgundy, Hainault passed to the House of Austria, but in 1659 a part of it was ceded to France, and is now included in the department of Nord.

Hainburg, or **Haimburg** (hīn′bụr*h*, hīm′bụr*h*), a town of Austria, beautifully situated on the Danube, 27 miles south-east of Vienna. It is walled; has an ancient town house, remains of a Roman aqueduct, and other antiquities. The old castle on the height is the Heimburg of the *Nibelungenlied*, the old frontier fortress of the Huns. Pop. (district), 15,200.

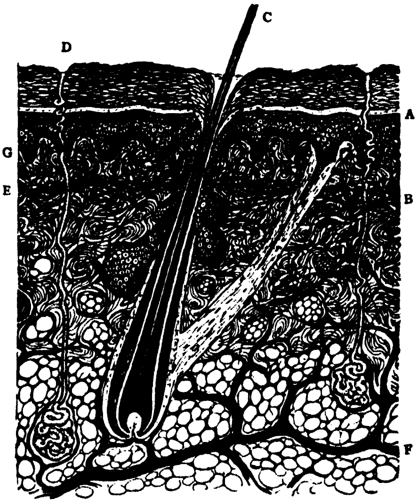
Hainichen (hī′ni*h*-en), a town of Saxony, 41 miles south-east of Leipzig. It has manufactures of woollen, linen, and cotton cloth, and is the chief seat of the German flannel manufacture. Pop. 8010.

Haiphong, chief port of the French colony of Tonking. It was opened to foreign residence and trade in 1876. Pop. about 18,500.



Hair as seen through a Microscope

Hair, the fine, thread-like, more or less elastic substance, of various form and colour, which constitutes the covering of the skin in the class of Mammalia. It has the same use as feathers in birds, and scales in fishes and reptiles. No species of Mammalia is without hair in an adult state, not even the Cetacea. In quadrupeds it is of the most various conformation, from the finest wool to the quills of a porcupine or the bristles of the hog. The human body is naturally covered with long hair only on a few parts; yet the parts which we should generally describe as destitute of it produce a fine, short, colourless, sometimes hardly perceptible hair. The only places entirely free from it are the palms of the hands and the soles of the feet; but the body of the male often produces hair like that of the head on the breast, shoulders, arms, &c. Each hair consists of a shaft and a root. The shaft or part outside the skin does not grow; but the root embedded in the skin expands at its lower end into a swelling or bulb which is composed of little cells and grows by forming new cells, the old ones being pressed forward and becoming part of the shaft. The colour is due to minute pigment granules in the cells of the hair. The colour of the hair is a race character; and the shape of the shaft has likewise been used in this way, transverse sections showing circular, oval, flat, or reniform outlines. The human hair varies according to age, sex, country, and circumstances. At birth an infant generally has light hair. It always grows darker and stiffer with age. The same is the case with the eyelashes and eyebrows. At the age of puberty the hair grows in the armpits, &c., of both sexes, and on the chin of the male. The hair of men is stronger and stiffer: that of females longer (even in a state of nature), thicker, and not so liable to be shed. Connected with the hairs are small glands which secrete an oily substance serving as a lubricant to the skin as well as the hair. These are called sebaceous glands. If the root is destroyed, there is no means of reproducing the hair; but if it falls out without the root being destroyed, as is often the case after nervous fevers, the hair grows out again of itself. Each hair, indeed, lasts only a certain time, after which it falls out and is replaced by another as long as the papilla is not weakened. Greyness of hair is caused by a deficient amount of pigment granules in the hair cells. The deficiency arises at the hair bulb where the cells are produced. Any influences that affect the nutrition of the bulb may thus affect the colour as well as the growth of the hair. Baldness is caused by atrophy of the papilla, generally due to lessened circulation of the blood in the scalp. For some diseases which have a close connection with the hair, see *Plica Polonica*, *Ringworm*, *Sycosis*. Under ordinary circumstances hair is a very stable substance.



Section of Skin of Mammal (highly magnified)

A, Epidermis. B, Cutis. C, Hair with follicle and sebaceous glands. D, Sweat ducts. E, Nerves and blood vessels. F, Artery. G, Papillæ.

It is the last thing which decays, and it often grows after death and lasts for centuries. Hair is not acted on by water, but heated in it under pressure it decomposes, evolves sulphuretted hydrogen, and dissolves; it is also dissolved by alkalies and acids. When burned, it emits a disagreeable odour as of burning horn.

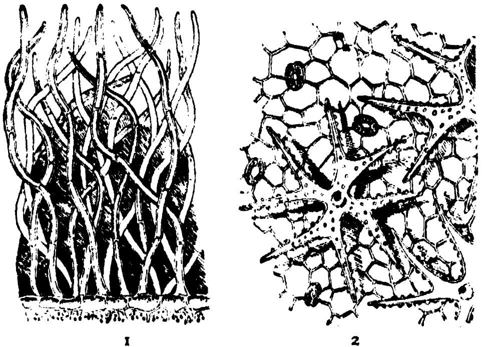
Hair for manufacture is obtained chiefly from the horse, the ox, the hog, the goat, especially the Angora or Mohair goat, the camel, and the alpaca. That of the first three is most used for upholstery purposes, the short hair being manufactured into curled hair for stuffing, and the long straight hair manufactured into hair-cloth for seating. The long hair is also reserved for the manufacture of fishing-lines, brushes, &c. White hair is of the most value, being most adapted for dyeing and for the manufacture of fancy articles. The horsehair used for weaving comes chiefly from Russia, Germany, Belgium, South America, and Australia. Before the European War Russia supplied the largest quantity of the bristles so largely used for brushes. The sable, the miniver, the marten, and the badger supply the finer brushes or hair-pencils of painters. The hair of the goat, the camel, and the alpaca is chiefly used in combination with or subordinated to wool and other fibres for spinning and weaving into dress fabrics. Human hair is used chiefly for the manufacture of wigs, curls, beards, chignons, &c. Most of the supply comes from France, Germany, and Italy, where the peasant girls sell their hair to itinerant dealers. In every case, and for any purpose, hair is always best taken from the living subject, dead hair being much inferior.—Bibliography: Walsh, *The Hair and its Diseases*; W. A. Kidd, *The Direction of Hair in Animals and Man.*

Hair-dyes, substances for giving hair some particular colour desired. The numerous preparations sold for this purpose have generally a basis of lead or nitrate of silver. Bismuth, pyrogallic acid, sulphur, the juice of green walnut shells and other astringent vegetable juices, are also employed.

Hair-grass (Aira), a genus of grasses belonging to that division of the order in which the spikelets have two or more florets, and the inflorescence is a loose panicle. It is of little use for cattle, which dislike it, but may serve where covert is wanted for game. *A. cæspitōsa,* or tufted hair-grass, the Scottish windlestrae, is used as thatch for ricks, and in some places for making mats.

Hair-powder, a preparation of pulverized starch and some perfume, formerly much used to whiten the head. Sometimes the powder was coloured. The custom of wearing it was introduced from France into England in the reign of Charles II. To make the powder hold, the hair was usually greased with pomade. It is now scarcely to be seen except on the heads of footmen in attendance on people of rank or wealth.

Hairs of Plants, outgrowths from the superficial layer or *epidermis*, consisting of one to many cells, and varying greatly in form and use. The commonest function of a hairy covering on leaves is the reduction of transpiration; other hairs secrete essential oils, resins, &c. (glandular hairs of Primula or Hop), or serve to absorb water (many epiphytes), or afford protection by their harshness (Boraginaceæ) or stinging properties (nettle). The *root-hairs* are the principal absorbing structures of the Higher Plants.



Hairs of Plants

1 Simple. 2, Stellate. Magnified about 50 diameters.

Hair-spring, in watches, the fine hair-like spring made of steel which is attached to the axle of the balance wheel, and serves by its resisting power to equalize the vibrations of the escapement-wheel.

Haiti, Hayti, or **San Domingo** (originally *Española*, or *Hispaniola*), one of the West Indies, after Cuba the largest and one of the most fertile of these islands. It lies south-east from Cuba, and is separated from it by the Windward Passage, 50 miles broad. Its length is 400 miles, and breadth 150 miles; area, about 29,500 sq. miles, or nearly as large as Scotland. It is of irregular form, and is intersected west to east by three chains of mountains, connected by offsets, with extensive plains and savannahs between. The central chain contains the highest peak, Loma Tina, 10,200 feet. The principal plain is the fertile Vega Real, between the northern and central ranges. The rivers are numerous, but of small size. The minerals include gold, silver, quicksilver, &c., but are greatly neglected, although efforts have recently been made to work copper-mines. Haiti as a whole is one of the healthiest of the West Indian Islands. The seasons are: a wet, during which heavy rains are most frequent in May and June; and a dry, during which little or no rain falls. The flora includes pines, mahogany trees, fustic, satinwood, lignum-vitæ, and other cabinet and dye woods, plantains, bananas, yams, batatas, oranges, pineapples, &c. The staple cultivated products are: coffee, sugar, indigo, cotton, tobacco, and cacao. The fauna includes the agouti, European cattle and pigs run wild, snakes, caymans, and turtles. Among the principal towns in Haiti are Port-au-Prince, San Domingo, Jacmel, and Cape Haitien.

Haiti was discovered by Columbus in 1492. It was then inhabited by perhaps 2,000,000 natives, but so ruthlessly did the Spaniards deal with the aborigines that within a century they practically exterminated them, having introduced negro slaves in their place. In 1630 the French settled in the western part of the island, and in 1697 the western portion was ceded to them, while the eastern remained Spanish. In 1791 the negroes revolted against France, and subsequently the whole island came under the negro leader Toussaint L'Ouverture, who established an independent republic. He was captured, but in 1803 Dessalines headed a new insurrection, drove out the French, and was crowned Emperor of Haiti. He was assassinated in 1806, and the Spaniards regained the eastern portion of the island. In 1821 the Spanish portion declared itself independent of the mother country, and assumed the name of Spanish Haiti; but it was subjugated by Boyer, the President of the Haitian Republic, or French Haiti. In 1844 the inhabitants of the Spanish portion rose, and formed themselves into a republic under the name of San Domingo (Republica Dominica). In 1861 Santana negotiated a reunion of the state with Spain, but Spain evacuated the island in 1865. From that period its history has presented an almost uninterrupted scene of revolution and bloodshed. It now comprises the Republic of Haiti on the west side of the island, and the Dominican Republic, Santo Domingo, on the east. Port-au-Prince is the capital of Haiti, and the population of the republic is roughly estimated at 2,500,000, consisting of negroes and mulattoes. The Constitution of the Republic of Haiti was ratified on 12th June, 1918, and the legislative power is vested in a Chamber of Deputies chosen for two years, and in a Senate of fifteen members elected for six years. The President is elected for four years. The area of the Republic of Haiti is estimated at 10,204 sq. miles. The religion is Roman Catholicism, the official language is French, and the prevailing dialect is known as Creole French. Education was made compulsory in 1910. In 1915 the United States established a protectorate over Haiti. See *Santo Domingo*.—BIBLIOGRAPHY: Sir

Spenser St. John, *Haiti, or the Black Republic*; H. Pritchard, *Where Black Rules White*; J. N. Léger, *Haiti: her History and Detractors.*

Hajipur, a town of India, in the Muzaffarpur district, Bengal, on the Little Gandak, a short distance above its confluence with the Ganges. Its command of water traffic gives it considerable commercial importance. Pop. 21,000.

Hake, the *Merluccius vulgāris* of Europe, and the *M. albĭdus* of North America, fishes belonging to that division of the cod family, or Gadidæ, which has the head much flattened, and two dorsal and one long anal fin. The European hake is known in some places as king of the herrings, on which it preys.

Hakim, a Turkish word, originally signifying *sage, philosopher*, and then a *physician*. *Hakim bashi* is the physician of the Sultan, that is to say, the chief of the physicians, always a Turk; whilst the true physicians in the seraglio under him are western Europeans, Greeks, and Jews.

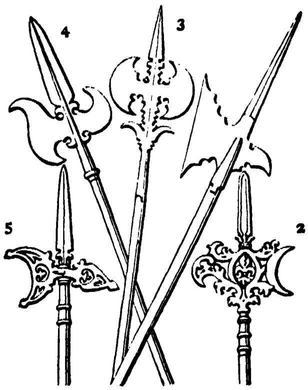
Hakluyt, Richard, one of the earliest English collectors of voyages and maritime journals, was born in 1553, died in 1616. He entered Christ Church, Oxford, in 1575, and became so eminent for his acquaintance with cosmography that he was appointed public lecturer on that science. About 1584 he went to Paris as chaplain to the English Ambassador, and stayed there five years. After his return home he prepared for the press his collection of *The Principal Navigations, Voyages, and Discoveries of the English Nation, made by Sea, or over Land, within the Compass of these 1500 Years.* The first volume, in folio, was published in 1589, and the third and last in 1600. Besides narratives of nearly 220 voyages, these volumes comprise patents, letters, instructions, and other documents not readily to be found elsewhere. Hakluyt died a prebendary of Westminster and rector of Wetheringset in Suffolk, and was interred in Westminster Abbey. The Hakluyt Society, named after Richard Hakluyt, was founded in 1846 for the purpose of printing rare and unprinted voyages and travels. More than 165 volumes have now been issued under its supervision. Hakluyt's *Voyages* were reprinted at Edinburgh (1889–90), and in London in 1904–6.—Cf. J. W. Jones, Introduction to the Hakluyt Society's edition of *Divers Voyages.*

Hakoda′te, a city of Japan, near the south end of the Island of Yezo, at the foot of a hill on the shore of a beautiful and spacious bay, which forms one of the best harbours in the world. Hakodate is one of the ports opened to British commerce through Lord Elgin's treaty with the Japanese Government in 1858. Pop. 133,698.

Hal, or **Halle**, a town of Belgium, province of South Brabant, on the Senne, about 10 miles from Brussels. It has a fine old Gothic church and town house; manufactures of beetroot sugar, soap, and leather. The town was occupied by the Germans from 1914 to 1918. Pop. 13,000.

Halacha (hal′a-ka), or **Halaka** (Heb., 'rule'), the Jewish oral or traditional law, as distinguished from the written law laid down in the Scriptures, and like it believed to be of divine origin. It was finally reduced to a written code forming part of the *Talmud.*

Halberd, or **Halbert** (O.Fr. *halebarde*, Fr. *hallebarde*), an offensive weapon, consisting of a pole or shaft about 6 feet long, having its head armed with a steel point edged on both sides. Near the head was a cross piece of steel somewhat in the form of an axe, with a spike or hook at the back. It was used by the Danes, Germans, and Swiss previous to the thirteenth century. In the English army it was much used in the sixteenth century, and gave its name to troops called *halberdiers*, to whom was confided the defence of the colours, and other special duties. It is now used only on ceremonial occasions.



Halberts

1, Halbert (time of Henry VIII). 2, Do. with fleur-de-lis (Henry VII). 3, Double-axed Halbert (Charles I). 4, Halbert (Charles II). 5, Do. (William III).

Halberstadt (hȧl′bėr-stȧt), a town of Prussia, in the province of Saxony, 32 miles s.w. of Magdeburg, on the right bank of the Holzemme. It is an old town, with many timber-framed and curiously ornamented houses. Its principal buildings are the cathedral, the Liebfrauen church, an old Episcopal palace, and town house. It has considerable manufactures of carpets, soap, leather, oil, and gloves. Pop. 46,480.

Hal′cyon, an old or poetical name for the kingfisher. It was fabled to lay its eggs in nests that floated on the sea, about the winter solstice, and to have the power of charming the winds and waves during the period of incubation, so that the weather was then calm; whence the term, *halcyon days*, signifying times of peace and tranquillity. See *Kingfisher.*

Haldane, Rt. Hon. Richard Burdon, Viscount Haldane, K.T., O.M., F.R.S., philosophical writer and politician, born 1856, and studied with distinction at Edinburgh and Göttingen. He was called to the Bar in 1879; entered Parliament as Liberal member for Haddingtonshire in 1885, a constituency which he represented till 1911. In 1890 he became Queen's Counsel, in 1902 a Privy Councillor, and in 1911 he was raised to the peerage. From 1905 to 1911 he occupied the post of Secretary of State for War, and was able to carry into effect a new scheme of army organization. From 1912 to 1915 he was Lord High Chancellor of Great Britain. He was Gifford Lecturer at St. Andrews University from 1902 to 1904, and has written *The Life of Adam Smith*, *Education and Empire*, *The Pathway to Reality*, and *The Reign of Relativity*, and is part author of *Essays on Philosophical Criticism*, and part translator of Schopenhauer's *World as Will and Idea.*

Hale, Sir Matthew, an eminent English judge, was born at Alderley, in Gloucestershire, in 1609, and died in 1676. He studied at Oxford, was called to the Bar, became a judge of the common bench in 1654, was knighted and made chief baron of the exchequer in 1660, and was raised to the chief-justiceship of the King's Bench in 1671. After his death appeared his *History of the Pleas of the Crown*, *The Jurisdiction of the Lords' House*, and *The History of the Common Law of England*; of which there have been repeated editions, with comments. He also wrote several religious works.

Hales, Alexander de, surnamed the *Irrefragable Doctor*, an English theologian, born at Hales, in Gloucestershire, date unknown, celebrated among the controversialists of the thirteenth century. He studied at the Universities of Oxford and Paris, became, in 1230, a professor in the latter city, where he died in 1245. His *Summa Theologiæ* put the *Sententiæ* of Peter Lombard into syllogistic form. He also commented on Aristotle, on the *Psalms*, and the *Apocalypse.*

Halesowen, a market town of England, Worcestershire, in a fertile valley 7 miles southwest of Birmingham; with manufactures of iron and steel goods, &c. Pop. 4121. The Leasowes, where Shenstone was born and died, was in the parish of Halesowen.

Halévy (à-lā-vē), Jacques François Fromental Élie, a French musical composer, born of Jewish parentage at Paris 1799, died at Nice in 1862. He studied at the Conservatory under Lambert and Cherubini, and was sent to Italy to finish his musical education. Here he wrote his first two operas, *Les Bohémiennes* and *Pygmalion.* The first of his pieces performed was a little comic opera, *L'Artisan*, given at the Théâtre Feydeau, in Paris, in 1827. His *chef-d'œuvre*, *La Juive*, appeared in 1835, and rapidly obtained a European celebrity. Among his other works are: *L'Éclair*, *Guido et Ginevra*, *La Reine de Chypre*, *Le Val d'Andorre*, *La Fée aux roses.* He was a cultivated and scholarly composer but without much genius.

Halévy, Joseph, French Orientalist, born at Adrianople 15th Dec., 1827, died in 1917. He studied in his native town and at Bucharest, and in 1868 was commissioned to study the conditions of the Falashas in Abyssinia. In 1869–70 he travelled in Yemen in search of Sabæan inscriptions. He was a prominent Biblical critic and an Assyriologist. He contended that the Sumerian people never existed, and that their so-called writing was a cryptography invented by the Babylonian priests. He founded and edited the *Revue Sémitique.*

Halévy, Ludovic, son of Léon Halévy, born in 1834, died in 1908, was a dramatist, a popular author of vaudevilles, and wrote the librettos of most of Offenbach's operas. He collaborated with Henri Meilhac, and their first success was *La Belle Hélène* (1865). Halévy also wrote novels, among which *L'Abbé Constantin* (1882) is famous.

Half-blood, in law, relationship by being born of the same father, but not of the same mother (consanguinean relationship); or born of the same mother, but not of the same father (uterine relationship). In the succession to real or landed property in England, the half-blood relations by the father's side succeed after the full-blood relations; and next, the half-blood relations by the mother's side.

Half-moon, in fortification, an outwork composed of two faces forming a salient angle, whose gorge is in the form of a crescent or half-moon.

Half-pay, in effect a species of temporary pension. An officer may be placed on the half-pay list either compulsorily, according to certain regulations, or, as substantive lieutenant-colonels or colonels, voluntarily. The most usual reason for being placed on the half-pay list is medical unfitness contracted in the service. Officers on the active list elected to the House of Commons are also usually placed on the half-pay list. The rates of half-pay vary, for example, from £1800 a year for a field-marshal, £3, 5*s.* a day for a full general (q.v.), 18*s.* 6*d.* for a senior major, to 9*s.* 6*d.* for a subaltern.

Haliaëtus (hal-i-a′ē-tus), the genus of birds to which belong the white-tailed sea-eagle or erne (*H. albicillus*) of Britain, and the white-headed or bald eagle (*H. leucocephalus*) of America, the chosen symbol of the United States. See *Eagle.*

Hal'iburton, Thomas Chandler, British humorous writer, born at Windsor, Nova Scotia, in 1796, died in 1865. He practised as a barrister in Halifax, wrote *An Historical and Statistical Account of Nova Scotia*, in 1829, and contributed a series of humorous letters to a Halifax newspaper under the pseudonym of 'Sam Slick'. These were published in book form and were augmented by others, forming *The Clockmaker, or Sayings and Doings of Samuel Slick.* In 1842 he became judge of the Supreme Court of Nova Scotia, but subsequently gave up his professional duties and came to reside in England. Here he published *The Attaché, or Sam Slick in England.* His hero again appears in *Sam Slick's Traits of American Humour* (1852). Another work of his of some importance is *Rule and Misrule of the English in America* (1851). In 1859 Judge Haliburton was elected member of Parliament for Launceston.

Hal'ibut, or **Hol'ibut,** the *Hippoglossus vulgāris*, one of the largest of the Pleuronectidæ or flat-fish family, sometimes attaining a length of over 10 feet and weighing more than 300 lb. The fish has a compressed body, one side resembling the back and another the belly, and both eyes on the right side of the head. It is caught on both sides of the Atlantic, and is much prized for the table.

Halicarnas'sus, in ancient geography, the capital of Caria, in Asia Minor, once an important city. Queen Artemisia erected here, in honour of her husband, King Mausōlus, the celebrated tomb hence known as the *Mausoleum.* Halicarnassus was the native place of Herodotus.

Halichondria (-kon'-), a genus of sponges comprising the common siliceous sponges of the British coasts. The crumb-of-bread sponge (*H. panicea*) encrusts rocks between tide-marks, and a branching species *H. oculāta*, is popularly known as the 'mermaid's glove'.

Halicore (ha-lik'o-rē). See *Dugong.*

Hal'idon Hill, an eminence about a mile to the north-west of Berwick, the scene of a disastrous defeat of the Scots by the English, 19th July, 1333. Edward III of England had laid siege to Berwick, the Governor of which promised to surrender on 20th of July if not previously relieved. On the 19th Archibald Douglas, Regent of Scotland, led a Scottish army to the relief of the town, and attacked the English at Halidon Hill, but was totally routed with the loss of 10,000 men.—Cf. A. Lang, *History of Scotland.*

Hal'ifax, Charles Montague, Earl of, an English poet and statesman, born in 1661, died in 1715. Educated at Westminster School and Trinity College, Cambridge, he first attracted notice by his verses, and in 1687 wrote, in conjunction with Matthew Prior, *The Town and Country Mouse.* He entered the House of Commons as member for Malden during the Convention Parliament, became a Lord of the Treasury in 1692, and Chancellor of the Exchequer in 1694. His administration was distinguished by the adoption of the funded debt system, and by the establishment of the Bank of England. In 1700 he was raised to the peerage as Baron Halifax, was twice impeached by the House of Commons, and remained out of office during the reign of Anne. Having taken an active part in securing the succession of the House of Brunswick, George I created him an earl, and bestowed on him the order of the Garter. In 1714 he became First Lord of the Treasury. His character was a mixture of meanness and arrogance, but his taste in literature and the arts was good, and he had a great talent for finance.—Cf. Burnet, *History of his Own Times.*

Halifax, George Savile, Marquess of, son of Sir William Savile, English statesman and writer, born 1630, died 1695. Having exerted himself for the return of Charles II, he was created Viscount Halifax in 1667, in 1669 Earl, and in 1682 Marquess of Halifax, being also Keeper of the Privy Seal and President of the Council. He supported James II, but lost his favour by opposing the repeal of the Test and Habeas Corpus Acts. He was chosen Speaker of the House of Lords in the Convention Parliament, and largely contributed to the elevation of William III to the throne. He wrote *Advice to a Daughter*, and various political tracts, such as the *Character of a Trimmer*, and *Maxims of State.* Halifax himself was a specimen of the trimmer, his conduct, however, being guided more by patriotic than personal reasons.

Halifax, a municipal and county borough of England, in the county of York (West Riding), on the Hebble, 36 miles w.s.w. of York. It is built on a rising slope, and has a very picturesque appearance. The more modern streets are spacious and well paved. Among the principal buildings are the parish church of St. John the Baptist (restored 1879), All Souls' Church, the Square Church, the town hall, market hall, theatre, assembly rooms, infirmary, and the Crossley and Porter orphan home and school. There are excellent schools and four public parks. Halifax commands abundant supplies of coal, and inland waterways connect it with Hull and Liverpool. It is one of the centres of the woollen and worsted manufactures in Yorkshire, a great variety of goods being produced. There are also iron-, chemical-, and machine-works. From 1832 to 1918 Halifax was also a parliamentary borough, sending two members to Parliament. Pop. 99,129.

Halifax, a Canadian city and naval station, capital of Nova Scotia, situated near the middle of the south coast, on the western side of Halifax harbour, one of the best and most spacious in North America, and easy of access for the largest ships at all seasons. The length of the harbour is about 6 miles, and it terminates in a beautiful sheet of water called Bedford Basin, within which are 10 sq. miles of good anchorage. City and harbour are strongly fortified, and there is an extensive dockyard, with a great graving dock. The European War retarded the improvements begun in 1914–5. Halifax is an important naval station, and the dockyard is now in Canada's hands. Being the Atlantic terminus of great railway systems, and a winter port, it has a steamship trade with Liverpool, New York, Boston, &c., and is also an important coaling-station. The industries embrace cotton, sugar, iron, paint, machinery, cars, and paper. The city has spacious and regular streets, some handsome public buildings, and among its institutions is the Dalhousie University. The city was founded in 1749 and named in honour of the second Earl of Halifax. Pop. 46,619.

Halio'tis, a genus of sea-snails, commonly called *ormers*, *ear-shells*, or *sea-ears*, found adhering to rocks on the shore, and remarkable for the pearly iridescence of the inner surface of the shell, which is perforated by a row of holes near the margin. They are esteemed as a delicacy in the Channel Islands. The name is derived from their likeness to an ear.

Hall, Basil, a naval officer and traveller, son of Sir James Hall of Dunglass, born at Edinburgh in 1788, entered the navy in 1802, and became post-captain in 1817. Amongst his principal works are: *A Voyage of Discovery to the west coast of Corea and the great Loo Choo Island* (1817); *Extracts from a Journal* (written on the Pacific coast of America); *Travels in North America* (1829); *Fragments of Voyages and Travels*; *Schloss Heinfeld, or a Winter in Styria*; besides many papers contributed to journals and scientific societies. Ultimately his mind gave way, and he died in Haslar Hospital, Gosport, in 1844.

Hall, Charles Francis, an Arctic explorer, born at Rochester, New Hampshire, United States, in 1821, died 8th Nov., 1871. He began life as a blacksmith; became a journalist in Cincinnati; in 1860 organized an Arctic expedition in search of Franklin, and remained amongst the Esquimaux two years, acquiring their language and habits. In 1864 he undertook a second expedition to the same regions, where he remained till 1869. In 1871, at the instigation of Hall, the United States Government fitted out the *Polaris* for an expedition to the North Pole, and placed Captain Hall in command. The *Polaris* sailed from New York 29th June, 1871, and on 30th Aug. reached lat. 82° 16′ N., and then turned back to winter in a sheltered bay, lat. 81° 38′, where Hall died. The *Polaris* was ultimately abandoned by her crew, who reached home only after experiencing many privations and adventures. An account of his first expedition was given by Captain Hall in his *Arctic Researches and Life amongst the Esquimaux*.

Hall, Edward, an English chronicler, born in London about 1495, died in 1547. He was a lawyer by profession, and attained the rank of a serjeant, and the office of a judge in the sheriff's court. He had a seat in the House of Commons, and was a zealous Catholic. Hall's great work, *The Union of the Noble and Illustre Famelies of Lancastre and York*, known as *Hall's Chronicle*, was first published in 1542. Other editions, containing a continuation compiled from Hall's notes by Richard Grafton, appeared in 1548 and 1550. It is a curious picture of the manners and customs of the age. An edition of the latter part of the *Chronicle*, by C. Whibley, appeared in 1904.

Hall, Joseph, an English prelate and writer, born 1574, died in 1656. He was educated at Emmanuel College, Cambridge, became successively Dean of Worcester, Bishop of Exeter (1627), and Bishop of Norwich (1641). He agreed with the Puritans in doctrine, but disapproved of their views of church government, and took a prominent part in defending the liturgy of the Church against the views published by the Nonconformists in the tract *Smectymnuus*. In 1642 he was sent to the Tower along with twelve other prelates who had protested against their expulsion from the House of Peers. In 1643, when the destruction of the Establishment was finally resolved on by the Puritans, he was specially named in the ordinance passed for sequestering what were called notorious delinquents, and heartlessly robbed of all his property by inquisitors, who turned him houseless into the streets. Ultimately he was allowed to take possession of a small estate which he possessed at Higham, in the vicinity of Norwich. Here he spent the remainder of his days unostentatiously, performing the duties of a faithful pastor. Amongst his writings are: *Virgidemiarum*, a series of poetical satires written in his earlier years; *A Century of Meditations*; and *Contemplations*.—Cf. G. Lewis, *Life of Joseph Hall*.

Hall, Robert, English Baptist minister, was born at Arnesby, Leicestershire, 1764, and died in 1831. He studied at the Baptist College at Bristol, and afterwards at Aberdeen. In 1783 he became assistant pastor of Broadmead Church in Bristol, suffered for a time from mental alienation, recovered, and became pastor of the Baptist church at Cambridge, where he soon acquired a great reputation by his preaching and his writings, such as *Apology for the Freedom of the Press* (1793), *Modern Infidelity* (1800), and *Reflections on War* (1802). He again became insane and resigned his charge, but, recovering, married and settled at Leicester in 1808, till in 1826 he was again called to Bristol. Nearly all his life he suffered so intensely from calculus in the kidney that for twenty years he was never able to pass an entire night in bed, and could obtain rest only by a ruinous use of laudanum. An edition of his works by Dr. O. Gregory appeared in 1831–3.

Hall, an ancient town of Austria, in the Tirol, 6 miles east of Innsbruck, on the Inn, which is here navigable. It has salt-works connected with the Salzberg (2000 ft.). Pop. 7520.

Hall, a town of Württemberg. See *Schwäbisch-Hall.*

Hallam, Henry, English historian, a son of the Dean of Bristol, born at Windsor in 1777, died in 1859. He was educated at Eton and Oxford, and studied for the law, but abandoned it for literary pursuits. His contributions to the *Edinburgh Review* brought him into notice, and his *View of the State of Europe during the Middle Ages*, which appeared in 1818, at once established his reputation. His next work, the *Constitutional History of England*, published in 1827, showed like the first the solid learning, patient research, accuracy and impartiality of statement, which are the characteristics of his work. Between 1837 and 1839 appeared his last great work, the *Introduction to the Literature of Europe*, a useful survey of literary history, though wanting in the fineness of judgment necessary for such a work. His eldest son, Arthur Henry, a youth of high promise, who died suddenly at the age of twenty-two, is the subject of Tennyson's poem *In Memoriam.*

Hallamshire, until 1918 one of the parliamentary divisions of the West Riding of Yorkshire, being that in which Sheffield is locally situated; one of the Sheffield parliamentary divisions is named Hallam.

Halle (häl′lė), usually called **Halle an der Saale** (Halle on the Saale), to distinguish it from other places of the same name, an important German town in the Prussian province of Saxony, about 20 miles north-west of Leipzig, on the River Saale. The older streets are narrow and crooked, but the appearance of the town has been much improved. Among the principal buildings are the church of the Virgin and that of St. Maurice, the ' Red Tower ' (a clock-tower) in the market-place, the mediæval town house, the ruined Moritzburg (originally the citadel), the university buildings, the Protestant cathedral, the theatre (comparatively new), and Francke's Institution, founded by Pastor Francke in 1698, comprising an orphan asylum and schools. The university, with which that of Wittenberg was incorporated in 1817, is a celebrated institution founded in 1694, and attended, before the European War, by about 2500 students. The town has extensive trade and manufactures, including chemicals, oils, dyes, and agricultural and other machines, besides its old and celebrated salt-works. Halle is mentioned as early as 1046. It was long a powerful member of the Hanseatic League. Pop. (1920), 182,326.

Halleck, Fitz Greene, an American poet, born in 1790, died in 1867. He became a clerk in a New York banking-house, and for years was in the employment of John Jacob Astor. In 1809 poems by him and a friend (J. R. Drake) appeared in the *New York Evening Post* under the signature of Croaker & Co., and attracted some attention. In 1820 he published *Fanny*, his longest poem, a satire on the follies and fashions of the day. In 1822 he visited Europe. Amongst his best poems are: *Marco Bozzaris*, *To the Memory of Burns*, *Alnwick Castle*, and *Red Jacket.*

Halleck, Henry Wager, an American general, born at Utica, near New York, in 1815, died in 1872. He was educated for the army at West Point, and entered the engineers in 1839. In 1846 he published *Elements of Military Art and Science*, and he was raised to the rank of captain for his services in the Mexican War. In 1854 he left the army and settled in San Francisco as a lawyer and director of a mining company. On the outbreak of the Civil War in 1861 he was created major-general in the United States army. After the victories at Paducah, Fort Henry, Fort Donelson, and the capture of Corinth, he became in 1862 commander-in-chief, till superseded by General Grant in 1864. Ultimately he received the command of the South Division at Louisville, where he died. Amongst his writings are two works on *International Law.*

Hall Effect, an electrical effect observed by E. H. Hall in 1879. When a current is passed through a very thin rectangular metal sheet by means of conductors connected to the mid-points of the short edges, on connecting the mid-points of the long edges to a sensitive galvanometer no current is at first observed. If a strong magnetic field is set up at right angles to the metal sheet, a feeble current now flows through the galvanometer. The magnetic field, by disturbing the position of the lines of flow, causes a small portion of the main current to flow through the galvanometer. The effect is positive in certain metals and negative in others; it appears to be related to the magnetic rotation of polarized light and to the change of resistance of metals in a magnetic field.

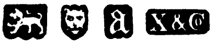
Halleluia, Hallelujah, or **Alleluia** (praise ye the Lord), a Hebrew formula of praise often occurring in the *Psalms*, and which is retained in the translations of the various Christian Churches, probably on account of its full and fine sound, so proper for public religious services. The *Great Hallel* is the name given by the Jews to *Psalms* cxx–cxxxvi, which are sung on the feasts of the Passover and Tabernacles.

Haller, Albrecht von, Swiss physician and physiologist, born in Bern 1708, died in 1777. He studied medicine at Tübingen, and afterwards at Leyden under the famous Boerhaave. He became a public lecturer on anatomy at Bern, and afterwards physician to the hospital and principal librarian. In 1736 he was made professor of anatomy and surgery in the University of Göttingen. In 1747 his *Primæ Lineæ Physiologiæ* appeared, and in 1757 his *Elementa Physiologiæ Corporis Humani*. Amongst his other works are: *Icones Anatomicæ* (1743), *Bibliotheca Botanica* (1771), *Bibliotheca Anatomica* (1774), *Bibliotheca Chirurgica* (1774), *Bibliotheca Medicinæ Practicæ* (1776). He was ennobled by the Emperor Francis I, and became chief magistrate of Bern, to which he had retired in 1753. Haller had a considerable reputation as a poet, and he also wrote three philosophical romances, *Usong*, *Alfred the Great*, and *Fabius and Cato*.

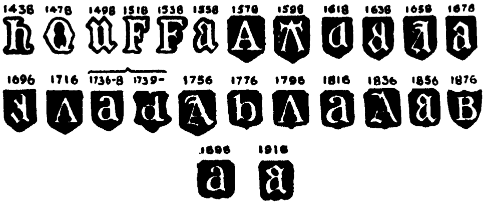
Halley, Edmund, an English mathematician and astronomer, born in 1656, died in 1742. He was educated at Queen's College, Oxford, published before he was nineteen a method for finding aphelia and eccentricity of planets, and stayed two years in St. Helena (1676–8) cataloguing the stars of the southern hemisphere and arranging them into constellations. In 1682 he discovered the comet which bears his name, and his prediction of its return in 1759 was the first of its kind that proved correct. He surveyed the coast of Dalmatia at the request of the German Emperor, and, returning to England, was elected Savilian professor of geometry at Oxford (1703). In 1713 he was made secretary of the Royal Society, and Astronomer Royal in 1719.

Halliwell-Phillipps, James Orchard, originally *J. O. Halliwell*, Shakespearian scholar, born 1820, died 1889. In 1839 he began his editorial labours with a reprint of *Mandeville's Travels*. He was a leading and active member of the Percy and Shakespeare societies; for the former he edited the *Minor Poems of Lydgate*, *Early Naval Ballads of England*, *Nursery Rhymes of England*, &c.; and for the latter, *The Coventry Mysteries*, *Tarleton's Jests*, *The Fairy Mythology of Shakespeare*, &c. His chief Shakespearian publications are a *Life of Shakespeare* (1848), the *Works of Shakespeare* (in 16 folio volumes, only 150 copies printed), *Calendar of the Records of Stratford-on-Avon*, *History of New Place*, and *Outlines of the Life of Shakespeare*. He issued also 47 volumes of lithographed facsimiles of the quarto plays, and a great number of pamphlets on Shakespeare, Stratford, and kindred topics. He also published a valuable *Dictionary of Archaic and Provincial Words*.

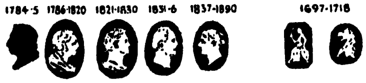
Hall-marks, the marks stamped on plate and other gold and silver goods, by means of which the quality (standard of precious metal contained), the maker, and the date of manufacture may be recognized. In the thirteenth century the London Guild of Goldsmiths and Silversmiths had attained great importance, a large monopoly, and numerous privileges. In order to ensure a high standard, each piece of plate was assayed and marked. The *King's Mark*, so named in 1363, was introduced in 1300 as a leopard's head; really a lion's head, miscalled leopard's owing to the heraldic term *leopart* being applied to a *lion passant guardant*.



London marks for the first year of the current cycle (1916): lion passant to indicate standard quality, leopard's head, the London hall-mark; date letter; and maker's initials.

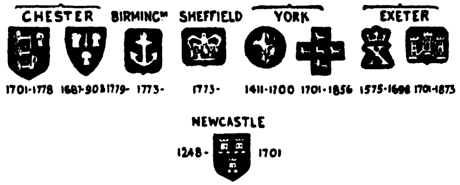


A characteristic London date mark from each cycle of 20 years, commencing in the year specified above the mark.

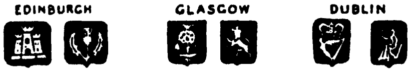


Duty marks indicating payment of duty, which was imposed only between 1784–1890. The two marks 1697–1718 on right were used when the standard was raised to 11 oz. 10 dwt., and may still be used for that standard. The usual one of 11 oz. 2 dwt. was restored in 1720 with the leopard's head and lion passant.

This mark, the hall-mark proper, still remains in use on London plate; the form has often changed in detail, the present head being much less bold in style than the original. The *maker's mark*, originally such a symbol as a fish, bird, horse, or—frequently—a rose or other flower, dates from 1363. In 1696–7 it was changed to the first two letters of the maker's name, and now consists of his initial. The *date mark*, first used in the fifteenth century—the earliest known example being that on the Nettlecombe chalice of 1479–80—is a single letter of the alphabet from A to U, J being excluded. One of several different forms of alphabet is used for a cycle of twenty years and then changed, Lombardic giving place to court-hand, small or capital Roman, black letter, &c. The shape of the shield enclosing the letters also varies; and in this way, the sequence of the cycles being known, the date of a marked piece is readily identified. *Duty mark*: this, the head of the reigning sovereign, was added in 1784, but disappeared in 1890 with the abolition of the duty upon plate. The *standard mark*, a lion for London, Birmingham, and Chester, denotes the standard proportion of 11 oz. 2 dwt. of silver to 18 dwt. of alloy; other marks denote various proportions of silver, while yet others are employed for gold and by the provincial assay towns. Nominally it was held that provincially-made plate must be sent to London, there to be assayed and marked; but difficulties of transit early led to the tacit recognition of provincial assays and marks, made either by the mayor, or, where a mint existed, by the master of the mint. York had in 1410 its own assay or 'touch'—so called from the primitive early method of rubbing the article upon a stone to test the quality; and in 1423 local assays were legalized for York, Newcastle, Lincoln, Norwich, Bristol, Salisbury, and Coventry. The marks of some of these towns, as also those of the present provincial assays (Birmingham, Chester, Sheffield, Edinburgh, Glasgow, Dublin), will be found in the accompanying plate. In 1483 the Edinburgh goldsmiths ranked with other metal-workers as 'hammermen', and two years later articles of local manufacture were to bear the maker's mark, the mark of the deacon of the guild, and the town mark. Glasgow, with a circuit of 40 miles around the city, was long independent of the rest of Scotland with regard to marks. A duty on Scottish manufactured plate was imposed in 1720, abolished in 1758, and reimposed in 1784.—Cf. C. J. Jackson, ***English Goldsmiths and their Marks.***



Town marks and the periods during which they have been used. York, Exeter, and Newcastle are now closed.



Scottish and Irish hall-marks and standard marks. The shape of the punch varies from time to time.

Hallow-even, or Hallowe'en, the evening of the 31st of Oct., so called as being the eve or vigil of All Hallows, or All Saints, which falls on the 1st of Nov. It is associated in the popular imagination with the prevalence of supernatural influences, and in Scotland is frequently celebrated by meetings of young people, with the performance of various mystical ceremonies humorously described by Burns in his poem *Hallowe'en*.—Cf. Sir J. G. Frazer, *The Golden Bough* (*Balder the Beautiful*).

Hallucinations, according to Esquirol, are morbid conditions of mind in which the patient is conscious of a perception without any impression having been made on the external organs of sense. Hallucinations are to be distinguished from illusions, for in these there are real sensations, though they are erroneously interpreted. Pinel was the first who connected hallucinations with a disturbance of the phenomena of sensation, and the investigation has been pursued further by Esquirol, Maury, Brière de Boismont, and others. All the senses are not equally subject to hallucinations; the most frequent are those of hearing; next, according to many, come those of sight, smell, touch, and taste; and hallucinations of several senses may exist simultaneously in the same individual, and also be complicated with certain delusions. The simplest form of hallucinations of hearing is the tingling of the ears; but the striking of clocks, the sounds of musical instruments and of the human voice are often heard, and in these instances, as in those of the perturbations of the other senses, there must be a diseased sensorium, though there should be no structural derangement of the nerves. Hallucinations are not confined to those whose mental faculties have been alienated, but occasionally assail and torment even the sane. Occasionally hallucinations supervene where the system is healthy, and the individual fully conscious of the unreality of the objects that address his senses. Sometimes this disorder is associated with much ability and wisdom in the conduct of life. Amongst well-known and authenticated hallucinations are that of the second Earl Grey, who was haunted by a gory head, which, however, he could dismiss at will, and that of Bernadotte, King of Sweden, who was beset in his rides by a woman in a red cloak, although perfectly conscious of the hallucination under which he laboured. Hallucinations may be caused by some experience which excited the emotions with such intensity that the patient represses the memory of the painful episode; in sleep, or at times when the repressive forces are relaxed, the memory of the experience is apt to force itself into consciousness in a more or less distorted form as a hallucination of vision, hearing, &c.—BIBLIOGRAPHY: J. E. D. Esquirol, *Mental Pathology*; W. James, *The Principles of Psychology*; H. Taine, *De l'Intelligence*; E. Parish, *Hallucinations and Illusions*.

Halluin (àl-ü-aṇ), a town of France, department of Nord, on the right bank of the Lys, 10 miles N.N.E. of Lille. It has considerable manufactures of cloths, linen, and calicoes, besides cotton- and oil-mills. It was occupied by the Germans during the European War. Pop. 16,000.

Hallux, the innermost of the five digits which normally compose the hind-foot of a vertebrate animal; in man the great toe, in a bird the hind-toe.

Halmstadt (hȧlm'stȧt), a seaport of Sweden, on the Cattegat, at the mouth of the Nissa. It has cloth-making, brewing, salmon fisheries, and a trade in deals, lumber, and pitch. Pop. 18,276.

Ha'lo. (1) *Halos proper* are due to refraction of light through minute crystals of ice. These crystals are mostly right hexagonal prisms. The angle between two adjacent sides is 60°, and that between a side and an end face 90°. From these different angles, and the different directions in which the axes may be oriented, various refractive effects can be produced. The halo most often seen has a radius of 22°; less frequently one of 46° radius is visible. The former is generally reddish on the inner border. Occasionally a horizontal circle is seen, at an altitude equal to that of the sun, through which it passes. Parhelia or mock suns, and paraselenæ or mock moons, when seen, appear at about 22° to right or left of the actual luminary. Sometimes halos have small tangent arcs at top or bottom. (2) *Coronas* are much smaller rings surrounding sun or moon and produced by diffraction of light. They are variable in size, and often show prismatic colour strongly, violet on the inside, red on the outside. (3) *Aureolas* or *glories* are the circles seen surrounding the shadow of an observer's head, or surrounding the shadow of a balloon or aeroplane, projected upon a cloud or fog-bank. The term *halo* was originally applied to the luminous ring which surrounded the head in representations of saints. The halo originated from the small metal plates or discs which the Greeks used to fasten over the heads of their statues to protect them from the droppings of birds.—Cf. Aristophanes, *Birds*, 1114 *seqq.*

Halogens (salt producers), the name given to a group of chemically related elements. The group comprises four elements: fluorine, chlorine, bromine, and iodine. Of these fluorine is the most active chemically, and activity decreases, iodine being the least active. Fluorine and chlorine are greenish gases at ordinary temperature, bromine a brown liquid, and iodine a blackish solid. The resemblance of these elements to one another is shown in the compounds. All four unite readily with hydrogen, yielding colourless gases soluble in water, the halogen acids hydrofluoric acid, hydrochloric acid, hydrobromic acid, and hydriodic acid. The halogens unite readily with the metals, forming salts, e.g. sodium fluoride, sodium chloride or common salt, sodium bromide, and sodium iodide; these again show marked resemblance.

Hal'ophytes, a class of plants which inhabit salt marshes and other saline ground, and by combustion yield barilla, as Salsola, Salicornia, and Chenopodium.

Haloragidaceæ, a small and peculiar natural order of polypetalous Dicotyledons, consisting mainly of widely distributed water- or marsh-herbs such as Hippuris (Mare's Tail), Myriophyllum (water milfoil), and Gunnera.

Hals, Frans, Dutch painter, born in Antwerp soon after 1580, is first heard of in Haarlem in 1611, where he studied painting under Karel van Mander. In 1637 he made a stay in Amsterdam, and there came under the influence of Rembrandt, which affected all his work. In earlier life a prolific and successful painter, he was subsequently deserted by his patrons, and his work takes on a more sombre, meditative character. In part owing to his dissolute habits, he was constantly in pecuniary embarrassment, and was finally supported by the municipality of Haarlem, where he died in 1666. Among the most notable work of his earlier period are *The Laughing Cavalier*, in the Wallace Collection, and the groups of the Haarlem Guild of Archers, in Haarlem; while characteristic of the later work are the groups *The Regents* and *The Regentesses*, at Haarlem. Hals is chiefly notable for the vitality and vigour of his portraits, and his brilliant and direct handling. He has exercised great influence, numbering among his followers many modern portrait-painters. A brother, Dirk, and several sons, notably Frans the Younger, were also painters of some note.

Halsbury, Hardinge Stanley Giffard, first Earl of, born in London 3rd Sept., 1823. He was educated at Merton College, Oxford, where he graduated B.A. in 1852. He was called to the Bar at the Inner Temple in 1850, and became a Q.C. in 1865. He was Solicitor-General from 1875 to 1880, and sat as Conservative member of Parliament for Launceston from 1877 to 1885. He was Lord High Chancellor of England from June, 1885, to Jan., 1886, from July, 1886, to Aug., 1892, and from June, 1895, to Dec., 1905. He was knighted in 1875, created Baron Halsbury in 1885, and Earl of Halsbury and Viscount Tiverton in 1898. As a barrister Lord Halsbury was engaged in the celebrated Overend and Gurney and Tichborne cases. As Lord Chancellor he did much to adapt English common law to the changing conditions of the times. As a politician he was prominent among the wing of his party which unfalteringly opposed the passing of the Parliament Act through the House of Lords. He was editor of *The Laws of England*, and Senior Grand Warden of English Freemasons. He died in Dec., 1921.

Halstead, a town of England, county of Essex, pleasantly situated on the Colne, 16 miles from Colchester. Pop. 5916.

Haltwhistle, an old market town of England, in the south-west of Northumberland, on the South Tyne, with interesting old houses and other antiquities, and coal-mines in the neighbourhood. Pop. 9751.

Ham, one of the three sons of Noah. He had four sons—Cush, Mizraim, Phut, and Canaan—from the first three of whom sprang the tribes that peopled the African continent, as Canaan became the father of the tribes that principally occupied the territory of Phœnicia and Palestine. See *Hamites*.

Ham (àm), a town of France, department of Somme, on the Somme. It is an ancient place, and contains a church with fine bas-reliefs and a curious crypt; but is chiefly deserving of notice for its citadel, which served as a State prison. Louis Napoleon (afterwards Napoleon III) was kept prisoner there from 1840 to 1846. During the European War the town was occupied by the Germans. Pop. 3000.

Ham, the inner angle of the joint which unites the thigh and the leg of an animal, but more generally understood to mean the cured and smoked thigh of the ox, sheep, or hog, especially the last. Usually the meat is first well rubbed with salt, and a few days after it is rubbed again with a mixture of salt, saltpetre, and sugar, though sometimes the saltpetre is omitted. After lying for eight or ten days it is ready for drying. The smoking of hams consists in subjecting them to the smoke of a fire, wood being used in preference to coal in the process of smoking. A good ham should have the recently-cut fat hard and white, the lean fine-grained and of a lively red.

Hamadan′, a city of Persia, on the site of the ancient Ecbatana, in the province of Irak-Ajemi, 260 miles north-west of Ispahan. It is agreeably situated near the base of a great range of mountains, has narrow and dirty streets, and is surrounded by heaps of ruins as well as by beautiful orchards and gardens. It has extensive caravanserais and bazaars, a number of tanneries, and also considerable manufactures of carpets, woollens, and cotton stuffs. It is an important centre of trade, especially for goods passing in or out of Persia by way of Bagdad, being on the route between this place and Teheran and other towns. Hamadan was occupied by British troops in 1918. Pop. about 35,000.

Ha′mah, or Ha′math, a city of Syria, on the banks of the Orontes or El-Azy, on the caravan route between Aleppo and Damascus, and on the railway that runs northwards towards Aleppo from the Beyrout-Damascus line, in a well-watered and productive district. It is a flourishing place, with manufactures of cotton and silk, but is of chief importance as an agricultural centre. The town is dirty and the streets narrow, the houses mostly built of sun-dried bricks and wood. The palace of the Governor and the mosques are the chief buildings, and there are also some fine private residences. Amongst the curiosities are huge Persian water-wheels, 70 or 80 feet in diameter, which are turned by the current of the river and supply the houses and gardens with water. The famous Hamath Inscriptions were noticed by Burckhardt in 1812. They are cut in relief on four stones of black basalt. The characters are entirely different from any others known, and no key to their decipherment has yet been discovered. They are believed to be in the Hittite speech. Hamah is a very ancient town, being repeatedly mentioned in the Bible (as Hamath). In early times it was the capital of a small kingdom which seems to have been included in the dominions of Solomon, and afterwards to have regained its independence, though subsequently taken by the Assyrians. It was known to the Greeks and Romans as Epiphaneia. In A.D. 639 it fell under the Mohammedan power. Pop. 45,000.—Cf. Burckhardt, *Travels in Syria and the Holy Land*.

Hamamelida′ceæ, the witch-hazels (or wych-hazels), a small natural order of dicotyledonous trees or shrubs, varying in height from 6 to 30 feet. *Hamamēlis virginica*, a native of North America, yields a useful drug. (See *Hazel*.) Another species belongs to Japan. One of the most important of the genera is Liquidambar (q.v.).

Ham′-beetle, the name for several beetles whose larvæ injure hams, the bacon-beetle (*Dermestes lardarius*) being often included.

Hamburg, a seaport and free city of Germany, the greatest commercial port on the continent of Europe, is situated about 80 miles from the North Sea, on the north branch of the Elbe, which is navigable for large vessels. The town of Altona adjoins it on the west. From the Elbe proceed canals which intersect the eastern and lower part of the city in all directions, and it is also intersected by the Alster, which here forms two fine lakes, the Binnenalster and Aussenalster, the former much smaller than the latter, which extends a considerable distance to the northwards. The quays and harbour accommodation are very extensive. After the destructive fire of 1842 whole streets were rebuilt in a magnificent and expensive style. Hamburg is not, however, very rich in notable buildings. Amongst the most important are the church of St. Nicholas's, a noble Gothic structure with a lofty tower and spire, built between 1845 and 1874; St. Peter's, another lofty Gothic edifice; St. Michael's (destroyed by fire in July, 1906); St. Catherine's, an ancient edifice; St. James's, erected in 1354, but surmounted by a modern tower; a graceful Jewish temple; the new Rathaus (town house or guild-hall), a fine large building in the Renaissance style; the court-houses (civil and criminal law-courts); an exchange, a noble edifice, consisting chiefly of a magnificent hall, surrounded by a fine colonnade. There are also the Johanneum Institution, containing an ancient college, museums, and the city library, with about 600,000 volumes; the new university; several well-endowed hospitals; zoological and botanic gardens; the Kunsthalle, a large collection of pictures and sculpture; and theatre. Hamburg is of most importance on account of its great shipping trade and the business of banking, exchange, and marine assurance carried on in connection with that. Until the beginning of the European War Hamburg was one of the greatest ports of the world, and its trade, paralysed between 1914 and 1919, again revived in 1920. Its manufactures and kindred industries, though large and varied, are less important, including shipbuilding (in several large establishments), the making of machinery, boilers, and many articles of metal, the smelting of ores of various kinds, tobacco- and cigar-making, sugar refining, spirit refining and distilling, brewing, &c. The harbour accommodation and equipment are most complete and extensive in the way of quays, docks (floating and other), cranes, warehouses, and railways; and a considerable area is set apart as a 'free harbour', being exempted from customs duties and restrictions. A great many emigrants embark there. The state of Hamburg, which with the free city forms a republic, embraces a territory of 160 sq. miles, and consists of two divisions, viz. (1) City of Hamburg, with a population of 985,784 (1921); (2) outlying towns and bailiwicks (Cuxhaven, Ritzebüttel, &c.), pop. 64,596. The legislative power belongs in common to the Senate and the House of Burgesses, but the executive power is vested chiefly in the Senate, which is composed of eighteen members. The members are elected for life. The House of Burgesses consists of 160 members. The present Constitution dates from 30th Dec., 1920. The revenue for 1920 was 346,264,764 marks, and the expenditure 594,078,408 marks; the public debt was in 1919 1,750,587,092 marks. The city owes its foundation to the Emperor Charlemagne, who (808–811) built a citadel and a church on the heights between the Elbe and the eastern bank of the Alster, as a bulwark against the neighbouring pagans. It became important as a commercial city in the twelfth century, and in the thirteenth it combined with Lübeck in forming the Hanseatic League. In 1618 Hamburg was formally acknowledged a free city of the empire. During the Thirty Years' War its population and prosperity continued to increase on account of the immunity of its position, and in the following century it obtained a large share of the trade with North America. In 1810 it was formally incorporated in the French Empire along with the north-western part of Germany. In 1815 it joined the Germanic Confederation as a free city. In 1888 the city was included in the Zollverein or German Customs Union. After the revolution of 1918, when there was rioting in the city, Hamburg remained within the German Reich, or new republic.—Cf. W. King, *Three Free Cities.*

Hamel, a French village, department of Somme. Captured by the Germans during the European War, it was retaken on 4th July, 1918.

Ham'eln, a town of Germany, in Hanover, on the Weser, which is here crossed by a suspension bridge. It has many picturesque old buildings and remains. Pop. 22,061.

Ha'merton, Philip Gilbert, an English painter and art critic, born at Laneside, in Lancashire, in 1834, died in 1894. He studied landscape-painting, but deviated into literature, publishing a work on *Heraldry* in 1851, and in 1855 *The Isles of Loch Awe* and other poems, illustrated by himself. In 1859 Hamerton married a French lady, and thereafter resided chiefly at Autun. He made himself well known to the English public as a writer on art, acting as art critic for the *Saturday Review*, and editing the *Portfolio.* His writings largely contributed to the revival of etching in England. Amongst his works are: *Thoughts about Art* (1862); *Etching and Etchers* (1866); *Contemporary French Painters* (1867); *Wenderholme*, a novel (1869); *The Intellectual Life* (1873); *Round my House* (1876); *Marmorne*, a novel (1878); *Modern Frenchmen* (1878); *Landscape* (1885); and *French and English* (1889).

Hamil'car, the name of several Carthaginian generals, of whom the most celebrated was Hamilcar, surnamed Barca (the lightning), the father of the great Hannibal. While quite a young man he was appointed to the command of the Carthaginian forces in Sicily, in the eighteenth year of the first Punic War, 247 B.C., when the Romans were masters of almost the whole island. For two years he defied all the efforts of the Romans to dislodge him; but the

Carthaginian admiral, Hanno, having been totally defeated off the Ægates, 241 B.C., he reluctantly consented to evacuate Sicily. A revolt of the returned troops, joined by the native Africans, was successfully repressed by Hamilcar. He then entered on a series of campaigns in Spain, where he founded a new empire for Carthage. Here he passed nine years, and had brought the whole southern and eastern part of the country under Carthaginian rule when he was slain in battle against the Vettones, 229 B.C. His great design of making Spain a point of attack against Rome was ably carried out by his son Hannibal.

Hamilton, Alexander, a distinguished American officer and legislator during the contest for independence, was born in 1757 in the Island of Nevis, West Indies, died 1804. At the age of sixteen he became a student of Columbia College, New York. On the outbreak of the war he received (1776) a commission as captain of artillery, and soon attracted the attention of Washington, who appointed him his aide-de-camp and employed him in the most delicate and difficult affairs. In 1781 he left the service, studied law, became a delegate from the state of New York in 1782, and in 1787 was one of the delegates who revised the Articles of Confederation. He was a strong supporter of the Federal party, and by the letters which he wrote to the *Daily Advertiser* of New York, afterwards published under the title of *The Federalist*, contributed greatly to the success of the party. On the organization of the Federal Government in 1789, with Washington at its head, Hamilton was appointed Secretary of the Treasury. This office he held till 1795, when he resigned and retired into private life. In 1798 he was appointed second in command of the provisional army raised under the apprehension of a French invasion, and on the death of Washington, in 1799, he became commander-in-chief. In 1804 he became involved in a political dispute with Aaron Burr, then candidate for the governorship of New York, accepted a challenge from that gentleman, and was shot by him, 11th July, 1804.—Cf. F. S. Oliver, *Alexander Hamilton*; F. T. Fox, *A Study in Alexander Hamilton*.

Hamilton, Anthony, Count, a poet, courtier, and man of letters, was descended from a younger branch of the family of the Dukes of Hamilton in Scotland, but was born in Ireland about 1646. After the death of Charles I he went with his parents to France, but after the accession of Charles II made frequent visits to England, and was appointed Governor of Limerick by James II. Afterwards, on the ruin of the royal cause, he accompanied the king to France. His talents and agreeable manners made him a favourite in the best circles. He died at St. Germain in 1720. Count Hamilton is chiefly known by his *Memoirs of Count Grammont* (his brother-in-law), a lively and skilful picture of the frivolous life at the French and English courts of the time. The count's other works are *Poems and Fairy Tales* (burlesque), which, as well as the *Memoirs*, are in French, and are also remarkable for their fine wit and elegance of style.

Hamilton, Emma, Lady, wife of Sir William Hamilton (q.v.), was the daughter of people in humble circumstances. She was born about 1761, and died at Calais 1815. After being his mistress, at the age of thirty years she became the wife of Sir William Hamilton, British Ambassador at Naples. It was while in this position that she made the acquaintance of Lord Nelson, who became devoted to her, although she was an ignorant woman, and set no bounds to her flatteries of Nelson. Nelson left her his house at Merton, and an annuity of £500, but she became hopelessly involved in debt, and died in distress after spending a year in a debtors' prison.—Cf. W. Sichel, *Emma, Lady Hamilton*.

Hamilton, Family of, a family long connected with Scotland, though probably of English origin, the name being evidently territorial. The first person of the name in Scotland of whom we have reliable information was Walter Fitz-Gilbert of Hamilton, who, in 1296, swore fealty to Edward I of England for lands in Lanarkshire, and held Bothwell Castle for the English at the time of the battle of Bannockburn. For his early surrender of this fortress King Robert Bruce gave him important grants of land. He continued faithful to King David Bruce, and had a command at Halidon Hill under the Steward of Scotland. In 1445 the family was ennobled in the person of Sir James Hamilton of Cadzow, who was created Lord Hamilton of Cadzow. At first he adhered to the Douglases against the Crown; but, deserting them opportunely, he was rewarded by large grants of their forfeited lands, and at a later period by the hand of the Princess Mary, eldest daughter of King James II, and widow of Thomas Boyd, Earl of Arran. He died in 1479. His only son was James, second Lord Hamilton and first Earl of Arran, who died in 1529, and was succeeded by his son James, whose nearness to the throne, and his great possessions and following, made him a person of such mark and consequence that Henry II of France gave him a grant of the duchy of Châtelhérault; and his eldest son was proposed at one time as the husband of Elizabeth of England, and at another as that of Mary of Scotland. This son having become insane, the second son, Lord John Hamilton, created Marquess of Hamilton in 1599, succeeded in 1575 to the family estates. Dying in 1604, he was succeeded by his son James, who was created

Earl of Cambridge in 1619, and died in 1625. His son James, the third marquess, one of the ablest and most distinguished of the family, created Duke of Hamilton in 1643 by Charles I, was taken prisoner by the Parliamentary forces soon after the battle of Preston, and beheaded in March, 1649. A successor was created Duke of Brandon in 1711, and was killed in a duel with Lord Mohun in 1712. James George, seventh duke, on the death of Archibald, Duke of Douglas, in 1761, became also the male representative and chief of the *red* or Angus branch of the House of Douglas, with the titles of Marquess of Douglas and Earl of Angus. He died in 1769, and was succeeded by his brother, Douglas, eighth Duke of Hamilton, who, in 1799, was succeeded by his uncle Lord Archibald Hamilton. He died in 1819, and was succeeded by his eldest son Alexander, who, dying in 1852, was succeeded by his only son William Alexander Anthony Archibald. In 1843 he married the Princess Marie of Baden, and he died at Paris 15th July, 1863. William Alexander Louis Stephen Douglas Hamilton, twelfth Duke of Hamilton, and ninth Duke of Brandon, premier peer of Scotland, and hereditary keeper of Holyrood House, died in 1895, and, leaving only a daughter, was succeeded by a distant kinsman.—BIBLIOGRAPHY: Sir R. Douglas, *Peerage of Scotland* (Sir J. B. Paul's edition); J. Anderson, *The House of Hamilton*; G. H. Johnston, *The Heraldry of the Hamiltons*.

Hamilton, Sir Ian Standish Monteith, British soldier, born at Corfu 16th Jan., 1853. Educated at Wellington College, he entered the army (Gordon Highlanders) in 1873, and saw service in the Afghan War (1878–9), the Boer War of 1881, being wounded and taken prisoner at Majuba Hill, and in Burmah (1886–7). During the South African War he was at Ladysmith as chief of the staff to Sir George White. He was made a general in 1915, and commanded the forces which landed on the Gallipoli Peninsula. He retired from the army in 1920. His works include: *A Staff Officer's Scrap Book*, *Icarus*, *Fighting of the Future*, and *A Gallipoli Diary*.

Hamilton, Patrick, usually considered as the first Scottish reformer, was the second son of Sir Patrick Hamilton of Kincavel and Stanehouse, and of Catherine, daughter of the Duke of Albany, second son of James II. He was born in Glasgow probably in 1504, and was educated partly at St. Andrews and partly at Paris, where he took his degree in 1520. While still a boy he had been appointed Abbot of Fearn, in Ross-shire, but never went into residence, settling instead at St. Andrews in 1523. Here he began to announce his convictions in the principles of the Reformation, and was summoned in 1526 by Archbishop Beaton to stand his trial for heresy. He fled to Germany, where his education as a reformer was completed by an intimate acquaintance with Luther and Melanchthon. After six months' absence he returned to Scotland, and began to preach the gospel openly at Linlithgow, but was allured by Beaton to St. Andrews under pretence of a friendly conference, put on his trial, convicted of various heresies, and burned at the stake, 1st March, 1527, in the twenty-third year of his age. His death did perhaps more to extend the principles of the Reformation in Scotland than even his life could have done.—Cf. P. Lorimer, *Life of Patrick Hamilton*.

Hamilton, Sir William, grandson of William, third Duke of Hamilton, was born in Scotland in 1730, died in 1803. In 1761 he was elected member of Parliament for Midhurst, and in 1764 he received the appointment of Ambassador to the court of Naples. He devoted his leisure to science, making observations on Vesuvius, Ætna, and other volcanic mountains; and the results of his researches are detailed in the *Philosophical Transactions*, and in his *Campi Phlegræi, or Observations on the Volcanoes of the Two Sicilies* (Naples, 1776–9, 3 vols. folio). He took an active part in the excavation of Herculaneum and Pompeii, and collected a cabinet of antiquities, of which an account was published by D'Hancarville in a splendid work with finely-coloured plates. Sir William's second wife was the notorious Lady Hamilton (see *Hamilton, Emma, Lady*).

Hamilton, Sir William, a prominent Scottish metaphysician, was born in 1788 at Glasgow, and died suddenly at Edinburgh in 1856. He studied with distinction in his native town, where his father and grandfather held in succession the chairs of anatomy and botany. In 1809 he entered Balliol College, Oxford, as a Snell exhibitioner, and gained a first-class in 'Greats'. In 1813 he was admitted to the Scottish Bar, but never acquired a practice in his profession, his taste lying much more towards the study of philosophy, in which he had already made extensive researches. In 1820 he became a candidate for the chair of moral philosophy in Edinburgh, rendered vacant by the death of Thomas Brown, but being defeated by Professor John Wilson he was obliged to content himself with the unimportant chair of universal history, to which he was appointed in 1821 by its patrons, the Faculty of Advocates. In 1829 the publication in the *Edinburgh Review* of his celebrated critique of Cousin's system of philosophy gave him at once a first place amongst the philosophical writers of the time. This was followed in 1830 by his criticism of Brown, and in 1831 by his article on the authorship of the *Epistolæ Obscurorum Virorum*. In 1836 he was appointed to the chair of logic and metaphysics in Edinburgh University. Here he gathered about him a number of ardent students, and re-established the fame of the Scottish school of metaphysicians, which had begun to wane. In 1846 he published an annotated edition of the works of Thomas Reid, and in 1854 the first volume of a similar edition of the works of Dugald Stewart. His lectures on logic and metaphysics were collected and edited by Dean Mansel and Professor Veitch. Hamilton's most important contributions to philosophy are connected with his doctrine of the Quantification of the Predicate in his system of logic; his theory of the 'relativity of knowledge', in the Kantian sense, held along with an apparently incompatible doctrine of immediate perception of the non-ego; and his definition of the infinite or unconditioned as a mere negation of thought.—BIBLIOGRAPHY: J. Veitch, *A Memoir of Sir W. Hamilton*; J. Seth, *English Philosophers and Schools of Philosophy.*

Hamilton, Sir William Rowan, mathematician and astronomer, was born in Dublin in 1805, died in 1865. Before he had completed his fourteenth year he had made himself acquainted with thirteen languages, among which were Arabic, Persian, Hindustani, Sanskrit, and Syriac. At the age of seventeen he was pronounced by a competent authority the first mathematician of his age. At Trinity College, Dublin, he gained the highest honours, and he was appointed in 1827 professor of astronomy in Trinity College, as well as Astronomer Royal. He was knighted in 1835, and elected in 1837 president of the Royal Irish Academy. He contributed numerous papers to the transactions of learned bodies, and made some valuable discoveries; but his fame is chiefly founded on his invention of the calculus of quaternions, a new method in the higher mathematics. Amongst his published works are: *General Method in Dynamics*, *Algebra as the Science of Pure Time*, and *Memoirs on Discontinuous Functions.*

Ham'ilton, a royal burgh of Scotland, in Lanarkshire, on the Clyde, about 10 miles south-east of Glasgow. Numerous villas and gardens give it a pleasant rural aspect. Coal, ironstone, and limestone are extensively worked in the vicinity. The county buildings, town hall, and extensive cavalry barracks are the most important public buildings. Near the town was Hamilton Palace, seat of the Duke of Hamilton, a large building, built in 1700 and rebuilt in 1830, but found unsafe and, with the splendid mausoleum, dismantled (1921). In the adjacent grounds are the ruins of Cadzow Castle and a few old oaks, the remains of Cadzow Forest. Here a herd of wild cattle is kept, white, with black ears and muzzles. Hamilton gives name to a parliamentary division of the county, returning one member to Parliament. Pop. 39,420.

Hamilton, the inland metropolis of the western district of Victoria, Australia, 224 miles W. of Melbourne, with which it is connected by railway. There are a hospital, town hall, mechanics' institute, a district college, the usual Government buildings, churches, and schools, and a number of hotels. The district is pastoral and agricultural. Pop. 5000.

Hamilton, a town of the colony or state of New South Wales, 100 miles N. of Sydney and connected by railway; with churches, schools, municipal buildings, &c.; collieries give employment to a number of hands. Pop. 7900.

Hamilton, the capital of the Bermudas, on the coast of the largest island, near the middle of the group. It has a landlocked harbour. Pop. 2627.

Hamilton, a city of Canada, the third largest in the province of Ontario, is beautifully situated on Burlington Bay, at the west end of Lake Ontario, and is overlooked by the eminence known as Hamilton Mountain, on which are many handsome residences. It is on the edge of the Niagara Peninsula, and thus belongs to the finest fruit-growing district in Canada, and is an important railway centre. The city is well built, the streets are wide, well paved, and lined with trees, and there are many handsome public buildings and important institutions. It is the seat of an active trade, and manufactures large quantities of iron goods, including machinery and stoves. Pop. (1919), 108,143.

Hamilton, a town, United States, Ohio, capital of Butler County, on the Miami River, 25 miles N. of Cincinnati. It is a prosperous manufacturing place, has woollen- and cotton-factories, paper- and saw-mills, and iron-foundries. Pop. (1920), 39,675.

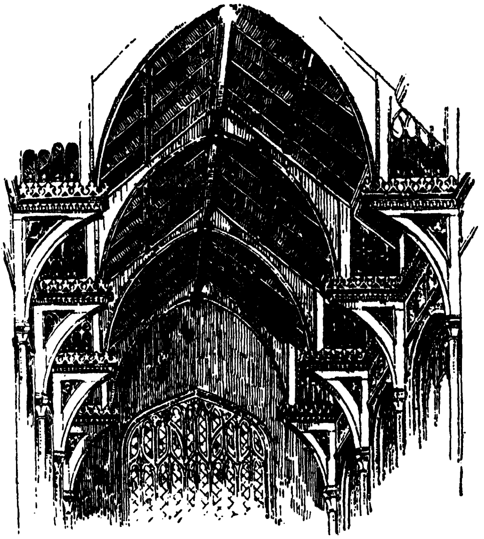
Hamirpur, a town of India, in the United Provinces, on the right bank of the Jumna. Pop. 7452.

Hamites (descendants of Ham), the name given to a number of peoples in North Africa, who are regarded as of kindred origin and speak allied tongues. They include the ancient Egyptians and their modern descendants, the Copts, the Berbers, Tuaregs, Kabyles, the Agaos, the Bejas, the Gallas, Somali, Dankali, &c. The Hamite race is closely akin to the early Mediterranean, so-called Iberic race, as well as to the Arabs (who belong to the so-called Semitic race).—Cf. A. H. Keane, *Man, Past and Present.*

Hamm, a town of Prussia, province of Westphalia, at the confluence of the Ahse with the Lippe. Its industries embrace iron-foundries and machine-works, rolling-mills and puddling-works, and wire-works. Pop. 43,660.

Hammer-beam, a short beam attached to the foot of a principal rafter in a roof, in the place of the tie-beam. Hammer-beams are used in pairs, and project from the wall, extending less than half-way across the apartments. The hammer-beam is generally supported by a rib rising up from a corbel below; and in its turn forms the support of another rib, constituting with that springing from the opposite hammer-beam an arch.

Hammerfest, a maritime town in Norway, in Finmarken, on Hvalöe (Whale Island), a bare, treeless, barren spot, in lat. 70° 40′ N., being thus the most northerly town in the world. It is a fishing centre, and carries on a lively trade. Though within the Arctic circle, the winter is comparatively mild, and the surrounding waters seldom freeze. Pop. 2709.



Hammer-beam Roof, St. Stephen's, Norwich, 1480

Hammer-oyster, a bivalve shell-fish, *Malleus vulgāris,* inhabiting the Indian Archipelago, resembling the pearl-oyster when young, but becoming always more hammer-like as it advances in age, by the lengthening of its two ears. It belongs to the wing-shells (Aviculidæ).

Hammersmith, a municipal and parliamentary borough of London, about 6 miles W.S.W. of the General Post Office. The Thames is here crossed by a fine suspension bridge. Formerly celebrated for its nurseries and market-gardens, it is now a busy commercial district. Hammersmith returns two members to Parliament. Pop. 130,287.

Hammock (Sp. *hamaca*), a rectangular piece of cloth or netting about 6 feet long and 4 feet wide, gathered together at the two ends and slung horizontally, forming a sort of bed. Hammocks are in common use on board ships of war. The word, probably derived from the hamack tree, is said to be of Caribbean origin, and the Caribs certainly make use of similar hanging beds.

Hammura'bi, a king of ancient Babylonia, who flourished about 2250 B.C., and did much for the welfare of the country, encouraging agriculture and commerce by irrigation and otherwise, regulating the finances, and building temples. To him is attributed a code of laws discovered in the end of 1901, inscribed upon a block of stone found in the ruins of Susa, and extending to 282 paragraphs, being the oldest law-book known. The laws pertain to civil and criminal matters, are of an enlightened character, and long prevailed in Babylonia, as well as having an influence extending to the Persians and Jews.—Cf. S. A. Cook, *The Laws of Moses and the Code of Hammurabi.*

Hamoon, Lake. See *Seistan.*

Hampden, John, celebrated for his patriotic opposition to taxation by prerogative, was born in London in 1594, being cousin-german by the mother's side to Oliver Cromwell. In 1609 he was entered a gentleman commoner at Magdalen College, Oxford. He began the study of law in the Inner Temple, but, having inherited an ample fortune on his father's death, he lived the usual life of a country gentleman. He entered Parliament in the beginning of Charles I's reign as member for Grampound, and continued to sit in the House of Commons three times in succession as member for Wendover, and finally as member for Bucks. Although for some years a uniform opposer of the arbitrary practices in Church and State, it was not till 1636 that his resistance to Charles's demand for ship-money made him the argument of all tongues. Although the decision in the Court of Exchequer was given against him by seven voices to five, the victory, as far as regarded public opinion, was his. In the following year (1637) he was one of those who meditated emigration to America, which they were prevented from carrying out by an Order in Council detaining them. Henceforward he took a prominent part in the great contest between the Crown and the Parliament, and was one of the five members whom the king, in 1642, so imprudently attempted, in person, to seize in the House of Commons. When the appeal was made to the sword, Hampden accepted the command of a regiment in the Parliamentary army under the Earl of Essex, and was fatally wounded on Chalgrove Field, 18th June, 1643, dying six days later.—Cf. Lord Nugent, *Memorials of John Hampden.*

Hampshire, Hants, or **Southamptonshire,** a maritime county, including the Isle of Wight, in the south of England; area, 958,896 acres. Its surface is pleasantly varied with gently rising hills, fruitful valleys, and extensive woodlands. The coast-line is very irregular; the principal indentation, Southampton Water, is navigable almost to its head for vessels of considerable burden. The country is well watered by the Avon, Exe, Test, Itching, and Hamble. In the west is the New Forest; in the south-east are the Forests of Bere and Waltham Chase. Two ranges of chalk hills, the North and South Downs, traverse the county, running in direction nearly east and west. On the Downs large flocks of sheep known as the 'Hampshire Downs' are fed. Hampshire is also famous for its wool, bacon, honey, and timber. The manufactures are unimportant, but the shipping is very extensive. For parliamentary purposes it is divided into six divisions, viz. Aldershot, Basingstoke, Fareham, New Forest and Christ Church, Petersfield, and Winchester, one member for each. Pop. 910,333.—BIBLIOGRAPHY: T. W. Shore, *History of Hampshire*; W. Page, *Victoria History of the Counties of England.*

Hampstead, a municipal and parliamentary borough of London. It is situated on the declivity of a hill on the north-western side of the city, and has long been celebrated for its fine air and the beauty of its surroundings. It returns one member to Parliament. Hampstead Heath crowns the summit of the hill, and is one of the most frequented of public recreation grounds. On the Heath and near it are the old inns The Bull and Bush and Jack Straw's Castle. Pop. 86,080.

Hampton, a village of Middlesex, situated 14 miles s.w. of London, on the left bank of the Thames. Pop. 10,677. About a mile from the village are the palace and park of Hampton Court, originally built by Cardinal Wolsey in 1525. Hampton Court has been the residence of many sovereigns, from Henry VIII, to whom it was presented by Wolsey, down to George II. It contains a valuable collection of pictures by Holbein, Lely, Kneller, West, &c. Part of the palace is set apart for the residence of persons of rank in reduced circumstances. The gardens, which contain the Maze, the Grape Vine, and the Long Water, comprise about 44 acres.

Hampton Court Conference, a conference which took place in 1604 at Hampton Court, under the presidency of James I, between the representatives of the Episcopalian and Puritan parties in the Church. The proceedings consisted largely of browbeating of the Puritan members and theological dogmatizing on the part of the king himself. A few slight alterations were made in the *Common Prayer Book*, and it was determined that a new version of the Bible should be undertaken. This, the Authorized Version, appeared in 1611.

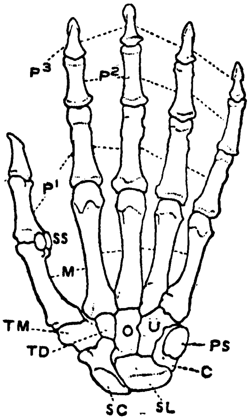
Hamster (Cricētus), a genus of rodent animals belonging to the family of the Muridæ (mice), and closely allied to the rats, which they resemble in their dentition. They are distinguished, however, by their having short hairy tails, as well as cheek-pouches in which they convey grain, peas, &c., to their winter residence. The common hamster (*C. frumentarius*) is from 10 to 12 inches without the tail, which is not more than 3 inches long. It is common in the north of Europe and Asia, but is not found in Britain nor to the south of the Alps. It is very destructive, sometimes storing as much as 60 lb. of corn in its burrow as winter provision. It is carnivorous as well as graminivorous, and hibernates during the colder months.

Han, a Chinese dynasty (206 B.C. to A.D. 220) with which commences the modern history of China. It was founded by Liupang, 217 B.C. to 195 B.C.

Han'aper, formerly an office in the Court of Chancery, so called because all writs regarding the public were once kept in a *hanaper* or hamper. The clerk of the hanaper received all fines due to the king for seals of charters, patents, commissions, and writs. The Act 5 and 6 Vict. cap. ciii transferred the duties of the hanaper office to other officials. The office was abolished in England, but survived in Ireland till 1921.

Hanau (hȧn'ou), a town of Prussia, province of Hesse-Nassau, at the confluence of the Kinzig with the Main, 13 miles E. of Frankfort. It is the chief manufacturing town in the province. It contains an ancient castle and an electoral palace (Philippsruhe), and has manufactures of jewellery, carpets, tapestry, silk and woollen goods, and ironware. During the Thirty Years' War, Ramsay, a Scotchman, held the town for nine months against the Imperialists (1653-6) till the siege was raised by the Swedes, an event still celebrated by the inhabitants; and in 1813 Napoleon there defeated the Bavarians under Wrede. Pop. 37,470.

Hand, the distal extremity of the arm, connected with the rest of the arm at the wrist; the principal organ of touch and prehension, and the instrument whereby man performs a great variety of highly-skilled actions which are his exclusive prerogative. The skeleton of the human hand is composed of twenty-seven bones, namely eight bones of the carpus or wrist arranged in two rows of four each, the row next the fore-arm containing the scaphoid, the semilunar, the cuneiform, and the pisiform, and that next the metacarpus, the trapezium, the trapezoid, the os magnum, and the unciform. The metacarpus consists of the five bones which form the palm, the first being that of the thumb, the others that of the fingers in succession. Lastly, the fingers proper contain fourteen bones called phalanges, of which the thumb has but two, all the other digits having three each. These bones are jointed so as to admit of a variety of movements, the more peculiar being those by which the hand is flexed backwards, forwards, and sideways, and by which the thumb and fingers are moved in different ways. The chief muscles which determine these movements are the *flexors*, which pass down the forearm, are attached by tendons to the phalanges of the fingers, and serve to flex or bend the fingers; and the *extensors* for extending the fingers. There are two muscles which flex all the fingers except the thumb. The thumb has a separate long and short flexor. There is a common extensor for the fingers which passes down the back of the forearm and divides at the wrist into four tendons, one for each finger, each being attached to all three phalanges. The forefinger and little finger have, in addition, each an extensor of their own, and the thumb has both a short and a long extensor. The tendons of the muscles of the hand are interlaced and bound together by bands and aponeurotic fibres, and from this results a more or less complete unity of action. It is sometimes difficult to make a movement with a single finger without the others taking part in it, as in executing instrumental music, for instance; but practice gives to these movements perfect independence. Of all the properties of the hand the opposition of the thumb to the other fingers, alone or united, especially characterizes the human hand. This action of the thumb results from its length, from the first metacarpal bone not being placed on the same plane as the other four, as is the case in the monkey, and from the action of a muscle—the long flexor of the thumb—peculiar to the human hand. This muscle completes the action of the other motor of the thumb, and permits man to hold a pen, a graver, or a needle; it gives to his hand the dexterity necessary in the execution of the most delicate work. In man the hand has attained a remarkable delicacy of perception, and powers of complicated skilled movements far transcending those of the apes and all other creatures. As a tactile instrument and a means of discriminating form, size, weight, and texture the human hand is one of the essential elements in man's intellectual supremacy. It cannot be considered, as in the ape, a normal organ of locomotion. It is essentially the organ of touch and prehension. It moulds itself to a body to ascertain its form; it comes to the aid of the eye in completing or rectifying its impressions. The functions of touch devolve principally upon its anterior or palmar face, the nervous papillæ abounding specially at the ends of the fingers. A layer of adipose tissue, very close in texture, protects, without lessening its power or its delicacy, the network of muscles, vessels, and nerves with which this remarkable organ is equipped.



Skeleton of Human Hand and Wrist

SC, Scaphoid. SL, Semilunar. C, Cuneiform. PS, Pisiform. TM, Trapezium. TD, Trapezoid. O, Os magnum. U, Unciform. M, The five metacarpal bones. P^1, P^2, P^3, Three rows of phalanges. SS, Sesamoid bones.

Handel (properly **Händel**), George Frederick, a great German composer, born at Halle, on the Saale, 23rd Feb., 1685, died 13th April, 1759. The strong passion which he early showed for the art overcame his father's opposition to training him as a musician, and at the age of seven he was placed under the tuition of Zachau, organist of Halle Cathedral, and was soon so far advanced in the practical part of the science as to be able to officiate occasionally as deputy to his instructor. In 1696 he was sent to Berlin, where he heard the music of Buononcini and Ariosti, then at the head of the Berlin Opera House. He returned to Halle, was appointed organist of the cathedral in 1702, but soon left to visit Hanover and Hamburg, where Steffani and Reinhard Keiser, the latter the greatest German operatic composer of his day, resided. At Hamburg he played second violin in the orchestra, and brought out in 1704 his first work, an oratorio on the *Passion*, and his first opera, *Almira*, followed in February by his *Nero*, and subsequently by his *Florinda and Daphne*. In 1706 he went to Italy, visiting Florence, Venice, Naples, and Rome. On his return to Germany he entered the service of the Elector of Hanover, afterwards George I of England, as musical director. He visited England twice, and ultimately, having received a pension from Queen Anne, settled down there. For some years his popularity was very great. He was placed at the head of the newly-founded Royal Academy of Music, and accumulated a large fortune in spite of the heavy losses which he incurred by setting up an opera company in opposition to that supported by the leading nobility and the principal Italian singers. Amongst the operas which he had composed up to this date (1735) are: *Radamisto, Ottone, Giulio Cesare, Flavio, Tamerlano, Scipio, Ricardo I, Orlando*, and *Ariadne*. His last opera was performed in 1740. By this time he had begun to devote himself chiefly to music of a serious nature, especially the oratorio. The approval which his first works of this kind (*Esther*, 1731; *Deborah*, 1732; *Athalia*, 1733) had met with encouraged him to new efforts; and he produced in succession *Israel in Egypt, L'Allegro and Il Penseroso, Saul*, and *The Messiah*. The last mentioned, which is his chief work, was brought out in 1741, for the benefit of the Foundling Hospital. It was not much appreciated at the first representation, but increased in reputation every year. In 1742 the *Samson* appeared, in 1746 the *Judas Maccabœus*, in 1748 the *Solomon*, and in 1752 the *Jephthah*. In 1752 he became blind, but did not lose his spirits, continuing to perform in public and even to compose. He died at London, and was buried in Westminster Abbey. Handel was of large and ungainly person. His manners were rough and his temper violent, but his disposition was humane and liberal. As a musician his characteristics are boldness and strength of style and combination of vigour, spirit, and invention in his instrumental compositions.—BIBLIOGRAPHY: W. H. Cummings, *Handel*; J. A. F. Maitland, *Age of Bach and Handel*; P. Robinson, *Handel and his Orbit*; R. A. Streatfield, *Handel*.

Handicapping is a system of equalizing the chances of victory in a contest by allowing certain advantages to an inferior competitor. Such a system is witnessed in the large majority of games and sports. Thus in horse-racing the best horses are compelled to carry heavier weights proportional to their capabilities. In athletic sports the principle of giving a start is in vogue, the best performer being on the ' scratch mark ', the others starting a selected number of yards in front of him, a distance based on their estimated form. Occasionally in a high-jumping contest the system is adopted of allowing a certain number of inches to be added to the athlete's actual performance, a system analogous to the time allowance sometimes seen in long-distance races when the men engage in what is known as a ' sealed handicap ', the time allowance of each being previously allotted, and deducted at the finish from the actual time taken. In lawn tennis, allowance is made either by making the best players owe points, or granting points to the inferior players; these two alternatives are often used conjointly. In golf, the handicap is based upon the number of strokes which a player generally requires to complete a course, and in a contest his handicap is deducted from the number of strokes he plays in his round. In cricket handicapping rarely occurs, but it is seen occasionally when a strong team handicaps itself by playing a bigger side of 14, 18, or even 24 players, or in such cases as ladies versus gentlemen, when the latter are handicapped by having to play with the left hand and using a broom handle instead of the orthodox bat. In chess, as is well known, a strong player may be handicapped by giving up one or more of his men at the beginning of his game. Perhaps football is the only game in which the system of handicapping is never seen.

Hand-plant, the *Cheirostĕmon platanoides*, a Mexican tree of the ord. Sterculiaceæ. It grows about 30 feet or more in height, and has flowers the stamens of which present an appearance somewhat like that of the human hand.

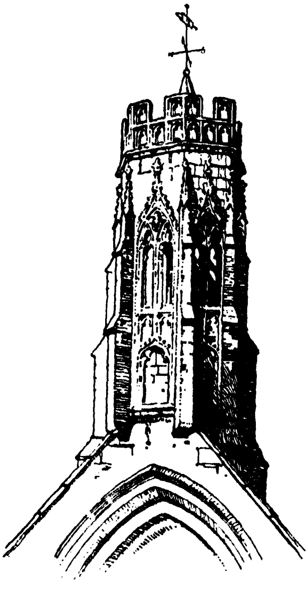
Hands, Laying on of. The rite, as a token of blessing, or the communication of spiritual gifts, or of something else which could not be literally delivered into the hands of another, has been in use from the earliest times. It occurs in Scripture as a patriarchal usage, appropriate and becoming perhaps rather than strictly religious, but later assumes more of the character of a formal rite, as in the ritual of animal sacrifice amongst the Jews, when the officer was required to lay his hands on the victim while still alive, except in the case of the paschal lamb. In the early Church this rite was used in benediction, absolution, the unction of the sick, and the reconciliation of penitents, as well as in ordination and confirmation. The rite is still retained by most Western Churches in the ceremony of ordination, and in the Roman Catholic, Anglican, and Lutheran Churches both in confirmation and ordination.

Handsworth, an urban district of England, Staffordshire, forming a north-west suburb of Birmingham. Pop. (urban district), 68,618.—Another *Handsworth* is in the West Riding of Yorkshire, forming an urban district 3 miles south-east of Sheffield, with collieries, quarries, &c. Pop. 15,889.

Hang-Chow, or **Hang-Choo**, a Chinese treaty port, capital of the province of Chekiang, on the estuary of the Tsien-tang-kiang. It is one of the handsomest cities of China, with many magnificent temples, monuments, and triumphal arches. It has extensive manufactures in silks, furs, gold and silver ornaments, tapestries, lacquered ware, fans, &c., and a large trade. The larger portion of the inhabitants live outside the walls in the beautiful suburbs and in boats on the river. It is also a great centre of literary and ecclesiastical life. Pop. estimated at 595,000.

Hanging-buttress, in architecture, a buttress not standing solid on a foundation, but supported on a corbel. It is applied chiefly as a decoration.

Hankow (' Mouth of the Han '), a town and river-port in China, in the province of Hupeh, at the junction of the Han with the Yangtze-kiang; Hanyang being on the opposite bank of the Han, and Wuchang on the other side of the Yangtze. The port was opened to foreign trade in 1862, and has become the chief emporium for the great tea districts in the central provinces, which formerly sent their produce for export to Canton. Large steamers ascend to the town. In 1857 Hankow fell into the hands of the Taiping rebels, and was almost completely demolished by them. In 1911 the town was attacked by the revolutionaries and partly burned. Pop. about 1,443,950.



Hanging-buttress, St. Helen's, York

Han'ley, a district, formerly a town, of North Staffordshire, England, pleasantly situated on rising ground near the Trent, 18 miles north by west of the county town of Stafford. It is quite a modern town, owing its growth entirely to the vast manufactures of china and earthenware in which the inhabitants are mostly employed; there are also iron-furnaces, foundries, brick-works, and collieries. Formerly a parliamentary borough, Hanley now gives name to a parliamentary division of Stoke-on-Trent, in which it is now included. Pop. 66,255.

Hannay, James, a Scottish man of letters, born at Dumfries in 1827, died at Barcelona 9th Jan., 1873. At an early age he entered the navy, but left it in 1845 to become a reporter on the *Morning Chronicle* in London. In 1860 he went to Edinburgh as editor of the *Edinburgh Courant*, but resigned this post in 1864. In 1868 he was appointed British Consul at Barcelona. He wrote several novels, amongst which *Singleton Fontenoy* and *Eustace Conyers* are the best; also, *Lectures on Satire and Satirists*, *Studies on Thackeray*, and a *Course of English Literature*.

Hannay, Rev. James Owen, better known under his pen-name of *George A. Birmingham*, was born in Belfast in 1865, and educated at Haileybury and Trinity College, Dublin, where he graduated B.A. in 1887 and M.A. in 1895. He was rector of Westport, County Mayo, from 1892 to 1913. His novels include: *Spanish Gold*, *The Seething Pot*, *The Red Hand of Ulster*, and *The Lost Tribes*. They deal for the most part with the lighter side of Irish life. His play *General John Regan* (1913), which was highly successful in London, was strongly disapproved of in Ireland.

Han'nibal, one of the greatest generals of antiquity, born 247 B.C., was the son of Hamilcar Barca, also a general and leader of the popular party amongst the Carthaginians. He was but nine years of age when his father made him swear at the altar eternal hatred to the Romans. He grew up in his father's camp in Spain (see *Hamilcar*), but returned to Carthage when his father fell in battle, in 229 B.C. At the age of twenty-two he returned to the army in Spain, then commanded by his brother-in-law Hasdrubal, and three years after, on the murder of Hasdrubal, received the chief command by acclamation. Hannibal now prepared to carry out his great designs against Rome. His siege and capture of Saguntum, a city in alliance with Rome, led to a declaration of war from the Romans, who made preparations to carry on the war in Spain. But Hannibal, judging that Rome could be overthrown only in Italy, undertook his great march on Rome across the Pyrenees, the Rhône, and the Alps. He set out with 90,000 foot-soldiers, 40 elephants, and 12,000 horsemen. When he reached the northern foot of the Alps he had still 50,000 foot-soldiers, 9000 horse, and 37 elephants. When he arrived at the southern foot, after 15 days of incredible toils, his force had diminished to 20,000 foot-soldiers and 6000 horse. The point at which he crossed is generally believed to have been the Little St. Bernard. On the banks of the Ticino he first encountered a Roman army under Publius Scipio, and defeated it mainly by the superiority of his Numidian cavalry, 218 B.C. Shortly after, another Roman army, under Sempronius, was totally routed on the Trebia. After wintering in Cisalpine Gaul, Hannibal opened next year's campaign (217) by defeating the Roman general Flaminius, whom he enticed into an ambush at Lake Thrasymenus. In this battle half the Roman army perished, and the rest were taken prisoners. Hannibal now marched into Apulia, spreading terror wherever he approached. Rome, in consternation, proclaimed Fabius Maximus dictator, who sagaciously resolved to hazard no more open battles, but exhaust the strength of the Carthaginians by delay. But for some time the wisdom of this policy was not understood by his countrymen, who, dissatisfied with his inactivity, appointed Minutius Felix his colleague. The result was that the latter was drawn into a battle by Hannibal, and would have perished but for the aid of Fabius. After this the Roman generals avoided engagements, and Hannibal at this critical period saw his army wasting away in inactivity. Next year (216), however, the rashness of the new consul Terentius Varro gave Hannibal the last of his great victories. The battle was fought at Cannæ, the Romans under L. Æmilius Paulus and Varro numbering more than 80,000 men, the Carthaginians about 50,000, and ended in a total defeat of the Romans, 40,000 or 50,000 of whom were slain and the rest scattered. Instead of marching on Rome, Hannibal now sought quarters in Capua, where luxurious living undermined the discipline and health of his troops. The campaigns of 215, 214, and 213 were comparatively unimportant. While Hannibal was seizing Tarentum (212), Capua was invested by two Roman armies. To relieve Capua Hannibal marched on Rome, and actually appeared before its gates (211), but the diversion remained fruitless, and Capua fell. In 207 a reinforcement tardily sent by the Carthaginians to Hannibal, under command of his brother Hasdrubal, was intercepted by the Romans and destroyed at the Metaurus. Hannibal now retired to Bruttium (the toe of Italy), where he still maintained the contest against overwhelming odds, till, in 203, he was recalled to defend his country, invaded by Scipio. In Africa he was defeated by the Romans at Zama (202 B.C.), and the second Punic War ended, after a bloody contest of eighteen years, in Carthage having to accept the most humiliating conditions of peace. Hannibal now devoted himself as civil magistrate to restoring the resources of Carthage, and was working at reforms of administration and finance when the jealous Romans sent ambassadors to demand his surrender. He fled to the court of Antiochus of Syria, and offered his services for the war then commencing against the Romans. They were accepted, but Hannibal's advice for the conduct of the war was not followed, and he himself as commander of the Syrian fleet failed in an expedition against the Rhodians. In 190 B.C. Antiochus was forced to conclude a disgraceful peace with the Romans, one of the terms of which was that Hannibal should be delivered up. Hannibal, again obliged to flee, took refuge with Prusias, King of Bithynia, and is said to have gained several victories for Prusias against Eumenes, King of Pergamus, an ally of the Romans. But the Roman Senate once more sent to demand the surrender of their inveterate enemy, and Hannibal, finding that Prusias could not protect him, took poison rather than fall into the hands of the Romans. He died in 183 B.C. —BIBLIOGRAPHY: F. A. Dodge, *Hannibal* (Great Captains Series;) W. How, *Hannibal and the Great War between Rome and Carthage*; E. Hennebert, *Histoire d'Annibal* (3 vols.).

Hannibal, a town in the United States, in Marion county, Missouri, on the right bank of the Mississippi, 150 miles above St. Louis. It has tobacco factories, machine-shops, foundries, pork-packing establishments, saw- and flour-mills, and an extensive trade in lumber. Pop. (1920), 18,950.

Hanno, a Carthaginian navigator of the fifth and sixth centuries B.C., who made a voyage on the western coast of Africa for the purpose of discovery and of settling colonies. He wrote an account of his voyage, which still survives in a Greek translation known as the *Periplus of Hanno.* From this account Hanno would appear to have gone as far as the coast of Guinea.

Hanoi′, or **Kesh′o,** capital of Tonking, and of Indo-China since 1902, on the River Song-ka, in a fruitful plain. Gold and silver filigree, lacquered wares, silks, mat- and basket-weaving are its principal industries. Although the river is navigable only for small vessels the trade of Hanoi is considerable, chiefly with the southern provinces of China. There is a school of medicine for natives, opened in 1902, which since 1917 belongs to the University of Indo-China. Pop. (1919), 109,500.

Hanotaux, Albert Auguste Gabriel, French politician and historian, born at Beaurevoir, Aisne, in 1853. After being sub-chief of the Cabinet of Gambetta and chief of that of Jules Ferry, he entered the Chamber of Deputies in 1886 as member for the Aisne, opposed General Boulanger, and was Minister of Foreign Affairs from 1894 to 1895, and again from 1896 to 1898. He was an ardent supporter of the Franco-Russian Alliance, which was strengthened during his tenure of office. To a certain extent he was responsible for the Fashoda incident (1898). In 1907 he was elected a member of the Académie Française, and his works include: *Henri Martin* (1885); *Histoire du Cardinal Richelieu* (1893–1903), crowned by the Académie (Gobert prize); *L'Affaire de Madagascar* (1896); *La France et la Royauté avant Richelieu* (1898); *Histoire de la France contemporaine* (1903–8); and *Histoire de la Guerre* (1914–20).

Han′over (Ger. *Hannover*), formerly a kingdom in the north-west of Germany, now a province of Prussia. It is of very irregular shape, and is divided by intervening territories into three distinct portions, besides some small territories to the south, and a range of sandy islands lining the coast. The total area is 14,869 sq. miles. For administrative purposes it is divided into six districts—Hanover, Hildesheim, Lüneburg, Stade, Osnabrück, Aurich. The surface in the south is covered by the Hartz Mountains, but the rest of the country is a low, monotonous flat, with a gentle slope to the North Sea. The Ems, the Weser (with its tributaries the Leine and Aller), and the Elbe flow through fertile districts industriously cultivated for corn and flax. Near the coast the land is marshy, but feeds large numbers of very superior cattle. In Central Hanover the soil is of a barren, sandy nature. The Hartz Mountains are rich in minerals, the working of which is an important industry. Hanover was long connected with the Brunswick family, and subsequently more especially with the line of Brunswick-Lüneburg. Ernest Augustus, a prince of the latter line, became in 1692 the first Elector of Hanover, married a granddaughter of James I of England, and was succeeded in 1698 by his son, George Louis, who in 1714 became George I of England. Henceforth it was ruled in connection with England. In 1814 the Congress of Vienna raised Hanover to the rank of a kingdom, the crown of which was worn by George IV and William IV, but on the accession of Queen Victoria passed by Salic law to Ernest Augustus, Duke of Cumberland. In 1851 he was succeeded by his son, George V, but in 1866, Hanover having become involved in the Austro-Prussian contest, the kingdom was occupied by Prussian troops, and absorbed into the dominions of Prussia. Pop. of the province (1919), 3,017,366.

Hanover, capital of the Prussian province of Hanover, situated in an extensive plain on the Leine, which here receives the Ihme and becomes navigable. The old town, irregularly built and with many antiquated buildings, is surrounded by the handsome new quarters which have arisen to the north, east, and south-east. There are fine promenades, and a large wood with beautiful walks, the Eilenriede, lies on the eastern side of the city. Amongst the principal buildings are the market church, the old town house, the theatre (one of the finest in Germany), the royal palace, the Museum of Art and Science, the Royal Library (containing over 200,000 volumes), the Central Railway Station, and the Waterloo Monument. About a mile to the north-west is Schloss Herrenhausen, the favourite residence of George I, George II, and George V. Nearer the town is the colossal Welfenschloss, or palace of the Guelphs, now fitted up as a polytechnic school of high rank. Hanover is a manufacturing town of importance, producing machinery, iron-work, metallic goods of various kinds, chemicals, carpets, pianos, and stationery. It is first mentioned in 1163, and joined the Hanseatic League in 1481. It became the residence of the Dukes of Brunswick-Lüneburg, and capital of the principality in 1636. Pop. (1919), 310,431.

Han′sard, a firm of printers in London, which long printed the parliamentary debates and papers. The founder of the business was Luke Hansard (1752–1828), who, in 1800, became printer to the House of Commons. The reports of speeches printed were extracted from the London newspapers, but were generally sent to the speakers for revision. The name is still retained for the reports furnished by *The Times* staff from 1895 to 1908, and since that date by a Government staff.

Hanse Towns, certain German and other commercial cities of Northern Europe associated for the protection of commerce and united by what was called the *Hanseatic League*. In the middle of the thirteenth century the sea and land swarmed with pirates and robbers. In particular the thriving ports of the Baltic and the North Sea were infested, and in 1219 a compact was made between Hamburg, Ditmarsh, and Hadeln to protect the adjacent waters. This was followed in 1241 by an alliance between Hamburg and Lübeck to keep open the road across Holstein, connecting the North Sea with the Baltic. In 1247 this league was joined by Brunswick, and out of this grew the Hansa or league, which at its most flourishing period embraced eighty-five towns, maritime and inland, from Reval and Narva to Amsterdam and Middelburg, and from Cologne to Breslau and Cracow. Amongst these the town of Lübeck was recognized as the chief town of the League. Here assembled the Deputies of the other Hanse towns to deliberate on the affairs of the confederacy; but the decrees of the Diet had no effect unless they received the sanction of the separate towns. The chief trading centres of the League were the factories of Novgorod in Russia, Bergen in Norway, Bruges, and London (the so-called Steelyard). These factories were subject to an almost monastic discipline, which even required their officers to be celibates and live at a common table. During the latter half of the fourteenth century the power of the League was at its height. It had armies and navies, gained victories in war over the Kings of Norway and Denmark, and deposed a King of Sweden. It made thorough provision for the security of commerce on the Baltic and North Seas, constructed canals, introduced a uniform system of weights and measures, and developed the principles of mercantile law. But as its power and ambition increased it was felt to be an oppressive monopoly established mainly in the interests of the great seaport towns. It became less needful also for commercial security, as the princes learned the advantages of trade, formed naval forces of their own, and encouraged navigation. Most of the inland members of the confederation withdrew, and during the fifteenth and sixteenth centuries the cities of Hamburg, Lüneburg, and Lübeck were almost alone in their active efforts to maintain the power of the Hansa and secure for it the command of the Baltic. About the middle of the sixteenth century the Dutch became predominant in the Baltic trade. In 1597 England revoked all special privileges of the Hanseatic merchants, and in 1614 Lübeck, Stettin, Danzig, Brunswick, Lüneburg, Hamburg, Bremen, and Cologne, with a few smaller towns, were the only places that contributed to the support of the Hansa. The League still made desperate efforts to retain its monopolies, but the cost of doing so now became a heavy tax on the remaining allies. At the last General Assembly, held in 1630 at Lübeck, many of the members sent representatives only to renounce their allegiance. The name still remained attached to the free cities of Lübeck, Bremen, and Hamburg, under whose protection the surviving factories continued to exist, that of Bergen being still managed in the old way till 1763. In 1813 Frankfort-on-the-Main was included in the number of the Hanse towns, and in the German Confederation these four cities had together one vote in the Diet. Frankfort was incorporated in Prussia in 1866, but the three other towns are still separate constituents of Germany, with new Constitutions adopted in 1919.—BIBLIOGRAPHY: W. King, *Three Free Cities*; H. Zimmern, *The Hansa Towns*; G. F. Sartorius, *Geschichte des hanseatischen Bundes* (3 vols.).

Hansi, a town of Hissar district, Punjab, on the Western Jumna Canal. Pop. 14,576.

Hansom-cab, a two-wheeled hackney-carriage or cabriolet formerly used in large cities. It holds two persons besides the driver, who sits on an elevated seat behind the body of the carriage, the reins being brought over the top. The hansom was so named after its inventor, Joseph Aloysius Hansom, an English architect (1803–82).

Hanswurst, the name of a standing comic character on the older German stage, corresponding in its grotesque traits and mirthmaking qualities to the English clown or Italian harlequin. The name is equivalent to the Jack Pudding of England. As the title of a character in comedy, the name first occurs in 1573, but it was already used by Luther, in 1541, in his *Wider Hanns Worst.*

Hanumân′, in Indian mythology, the name of a fabulous monkey-god, who plays a prominent part in the epic *Râmâyana.* He was the son of a nymph by the god of the wind. Indra, envious of his prowess, tried to kill him by the thunderbolt, but only succeeded in breaking his jaw. From this circumstance he received the name *Hanūmān*, i.e. he of the (broken) jaw. As the monkey-general who aided Rama (the seventh incarnation of Vishnu) in his war against the giant Ravana, he is worshipped as a demigod, and on his account the whole tribe of monkeys, to which he is fabled to belong, is treated as sacred and allowed to multiply indefinitely.—Cf. A. C. Wilson, *Hindu Mythology.*

Han′way, Jonas, English traveller and philanthropist, born in 1712, died in 1786. At an early age he was apprenticed to a merchant at Lisbon, and in 1743 became a partner in a British house at St. Petersburg (Petrograd). He travelled in Persia, and published *An Historical Account of the British Trade over the Caspian Sea.* Afterwards he settled in London, where he became widely known as an active philanthropist. He is popularly known as one of the first Englishmen who regularly used an umbrella.

Hanwell, an urban district on the west of London, beyond Ealing; near it is the London County Lunatic Asylum. Pop. 20,485.

Hanyang. See *Hankow.*

Haptotropism, curvature of a plant-organ in response to the stimulus of touch; the most familiar illustrations are provided by the tendrils of climbing plants.

Hapur, a town of India, in the Meerut district, United Provinces. It has a considerable trade in sugar, grain, cotton, and timber. Pop. 19,140.

Har′akiri, or **Sep′puku**, a mode of inflicting death upon themselves allowed in Japan to criminals of the Samurai or two-sworded class as more honourable than public execution. It consists in cutting open the body so as to disembowel it by means of a wound made with one sword perpendicularly down the front and another with the other sword horizontally. It is frequently resorted to to save dishonour or exposure. In 1912 General Nogi and his wife, out of loyalty to the dead emperor, committed Harakiri on the eve of the funeral of their sovereign. During the Russo-Japanese War, 1904–5, Japanese officers captured by the Russians also resorted to this mode of suicide.—BIBLIOGRAPHY: B. H. Chamberlain, *Things Japanese*; J. H. Longford, *The Evolution of New Japan.*

Harar, a town of North-Eastern Africa, included in the Abyssinian territories, about 150 miles from the coast of the Gulf of Aden, now reached by a railway from the French port of Jibouti. The inhabitants are strict Mohammedans. Pop. estimated at 50,000.

Harbin, or **Kharbin**, a town of China, in Manchuria, province of Kirin, about 330 miles north-east of Mukden, near the right bank of the Sungari, a tributary of the Amur, and close to the Mongolian frontier. It is the place where the Siberian railway forks, one branch going to Mukden and Port Arthur, the other to Vladivostock. Pop. (1913), 68,000.

Harbour, any sheltered area of water on a sea coast which ships can enter, and in which they can safely anchor during stormy weather.

In ancient times, about 3000 B.C., the Phœnicians of Tyre had two harbours, one on each side of a peninsula, extending to about 14 acres and joined together by a ship canal. At a later date the Carthaginians and Romans made extensive harbours, and the latter constructed Civita Vecchia, Ostia, and many others; that at Ostia, built at the mouth of the Tiber, enclosed about 140 acres, and was provided with a lighthouse, 1½ miles of quays, grain warehouses, &c.

Harbours are either ‘ natural ’ or ‘ artificial ’. Natural harbours occur on deeply-indented coasts, and may be riverine estuaries or mouths of rivers, or simply a deep indentation with a comparatively narrow entrance. The estuaries of the Thames, Forth, and Clyde are entirely natural harbours, requiring no engineering works in their lower reaches, and, owing to their bell-mouth shape and ample depth of water, are of easy access. Milford Haven, Sydney Harbour, and many others represent deeply-embayed indentations which form excellent shelters. On the other hand, there are many stretches of coast where the art of the engineer has to be employed, either to improve the shelter of areas of water already partially protected by the contour of the coast-line, as at Plymouth, or to construct an entirely new harbour completely enclosed by breakwaters, as at Madras. The latter is a notable instance of a harbour constructed on a long, straight stretch of coast, and consists of breakwaters in the form of three sides of a square projected out into the sea, having an entrance at the outer northern corner.

Navigable rivers with narrow mouths also require protective breakwaters projected out in a horn shape and converging to a narrow entrance, ranging sometimes from 400 to 600 feet. The distance of the entrance to the river mouth should be such that ships on entering the smoother water can lose way sufficiently to be under control when negotiating the narrow river mouth.

The tides play a very important part. Where there are no tides, as in the Mediterranean, river estuaries are blocked with deltas, and the river is split up into many mouths, generally only navigable in the natural condition for small craft. In the case of large rivers so situated, it is frequently possible to select one of the mouths and make it navigable for large vessels, as in the Mississippi and the Danube. Captain Eads, United States, by constructing parallel jetties in the former case, made one of the mouths navigable for ships of almost 30 feet draught, but at a cost of over £1,000,000. It is only possible to make very large rivers navigable under such conditions because of the large volume of fresh water available to prevent silting by keeping the channel scoured. It is a consequence that, except in similar cases to those mentioned, all ports in tideless seas are on or near the coast.

If this state of things is compared with that obtaining in tidal waters, it will be noted that large ports are frequently many miles up rivers. The tide, in fact, acts as the scouring agent, clearing out deltas and conserving the depth of navigation channels in estuarine harbours. It enables comparatively small rivers, such as the Thames, Forth, and Clyde, to act as harbours in the outer reaches and conveyers of ships to far inland ports. Hamburg is 75 miles from the sea, and had there been no tides, neither that port nor the ports of London and Glasgow would be in existence.

Harbours have been built at enormous cost which have proved quite inadequate for their purpose, owing to lack of due appreciation of the conditions. One harbour in Brazil, costing about £1,000,000, is practically useless, owing to silting up with littoral drift. In another case, after the harbour was built, it was found that a 5-knot current set in across the entrance at certain states of the tide, making it dangerous for shipping. In riverine estuaries and narrow river mouths one of the chief difficulties is the tendency to silt up at the point where they join the open water, forming an incipient delta termed a ‘ bar ’: the water shoals suddenly, forming a more or less pronounced mound, and this is due partly to littoral drift and partly to detritus carried down by the river current and deposited where the current is checked. The method of removing this is either to form training walls to concentrate tidal scour, and so to sweep out a navigable passage through the bar, or simply to dredge it out.

Harbours are of three categories, according to their uses: (*a*) refuge harbours, (*b*) commercial harbours, and (*c*) fishery harbours. Class (*a*) are constructed on dangerous coasts where there are no natural harbours. They must be easy to reach, and must provide good shelter. Peterhead breakwater is an example of a national harbour of refuge constructed to save ships caught in a nor’-easter from having to run back to the Forth. Class (*b*) are those which form the entrances or vestibules to ports, and they may at the same time be excellent harbours of refuge.

Class (*c*) are generally of small extent, but the entrances must be easily taken in rough weather. Such harbours are not always easy to design efficiently, and the works may be costly. The Government frequently assists by loans or grants.—Bibliography: W. Shield, *Harbour Construction*; B. Cunningham, *Harbour Engineering*.

Harbour Grace, a seaport of Newfoundland, on the west side of Conception Bay. It is the seat of a Roman Catholic bishop, has a handsome cathedral, and an active trade. Pop. 4279.

Harburg, a town in Prussia, in the province of Hanover, on the left bank of the South Elbe, opposite to Hamburg. It has varied manufactures and an important trade. Pop. (with suburb), 65,933.

Harcourt, Sir William George Granville Venables Vernon, lawyer and politician, son of Rev. William Vernon Harcourt, was born in 1827, died in 1904. He was educated at Trinity College, Cambridge; was called to the Bar in 1854, became Queen's Counsel in 1866; contributed frequently to the press, in particular the letters to *The Times* signed 'Historicus'; was returned for Oxford city in 1869 in the Liberal interest; distinguished himself by his powers of satire and ridicule in debate; was made Solicitor-General in Gladstone's ministry, Nov., 1873; Home Secretary in 1880, when he lost his seat for Oxford but was returned for Derby. He introduced the Arms Bill (Ireland), 1881; Prevention of Crimes Bill, 1882; and Explosives Bill, 1883. In 1886 he was Chancellor of the Exchequer under Gladstone, as he was under the same leader and under Lord Rosebery in 1892–5, when he remodelled the death duties.

Harden, Maximilian, German journalist and author, born in Berlin 1861. His real name was Witkowski, and he first wrote essays on political and social questions under the pseudonym of *Apostata*. A satirical writer of considerable talent, Harden frequently criticized the Government, especially that of Caprivi. In 1900 he was prosecuted for *lèse-majesté* and condemned to six months' imprisonment. In 1892 he founded the famous weekly paper the *Zukunft* (The Future), wherein he published numerous sensational articles. His famous campaign of 1907 against the friends of the ex-Kaiser, Philip zu Eulenburg and Wilhelm von Hohenhau, created a stir. During the European War Harden frequently criticized the German Government, which retaliated by suppressing his paper more than once. His works include: *Apostata* (1892), *Kampfgenosse Sudermann* (1903), *Word Portraits*, and *Monarchs and Men*.

Hardenberg, Friedrich von, German writer, better known under the name of *Novalis*, born 1772, died 1801. He studied at Jena, Leipzig, and Wittenberg, was the friend of Tieck and the Schlegels, and spent his brief life in study and literary production. He was one of the leaders of the 'Romantic School', and his writings are a strange mixture of imagination, profundity, and mysticism. Amongst his works are an unfinished novel, *Heinrich von Ofterdingen*, and *Spiritual Songs*.

Hardenberg, Karl August, Prince von, Prussian Chancellor of State, was born at Essenrode, in Hanover, in 1750, died in 1822. He entered the civil service of his country, but left it for that of Brunswick, and next became Prussian Minister of State, and in 1804 First Minister of Prussia. His conduct was vacillating, now favouring an alliance with Napoleon and again hostile to him. After the Peace of Tilsit, he was banished from the Prussian court by command of Napoleon, was recalled to office as Chancellor in 1810, and after the French disaster at Moscow was amongst the first to declare that the time had now come for a general effort against Napoleon. Hardenberg signed the Peace of Paris, and was created prince. He was one of the most prominent actors at the Congress of Vienna; became President of the Prussian Council of State; was present in 1818 at the Congress of Aix-la-Chapelle; in 1819 at Carlsbad; in 1820 at Troppau; in 1820–1 at Laibach; and in 1822 at Verona. He abolished feudal privileges in Prussia, and was a munificent patron of the sciences.

Harderwijk (hȧr-dėr-vīk), a town of the Netherlands, in the province of Gelderland, on the Zuider Zee, 30 miles east of Amsterdam. From 1648 to 1811 Harderwijk had a university, and it was also a Hanse town. Pop. 7415.

Hard-fern, the popular name for *Lomaria spicant*, which is also known as *Blechnum boreale*. It is a very common fern, being found everywhere in Britain growing on heaths, in glens, on old roadside walls, and other places.

Hardicanute, or **Harthacnut**, King of England and Denmark, was the only legitimate son of Canute. At the time of his father's death, in 1036, he was in Denmark, where he was immediately recognized as king. His half-brother Harold, however, who happened to be in England at the time, laid claim to the throne of that part of their father's dominions, and succeeded in getting possession of Mercia, Northumbria, and Wessex, but died in 1040, when Hardicanute succeeded him unopposed. He reigned till 1042, leaving the government almost entirely in the hands of his mother and the powerful Earl Godwin, while he gave himself up to feasts and carousals.—Cf. Sir C. W. Oman, *A History of England before the Norman Conquest*.

Hardie, James Keir, British politician and labour leader, born in Scotland 15th Aug., 1856, died 26th Sept., 1915. From the age of seven to twenty-four he worked in the coal-mines, and in 1880 was elected secretary of the Lanarkshire Miners' Union. He entered Parliament in 1892, and sat for West Ham from 1892 till 1895, and for Merthyr Tydfil from 1900 till his death. He edited the *Cumnock News* from 1882 till 1886, and afterwards founded and edited the *Labour Leader* (1887–1903). Hardie was one of the founders of the Independent Labour Party (I.L.P.) in 1893, was first chairman of the party, and again in 1913–4. He had a wide reputation as a Socialist, an anti-militarist, and a woman's suffragist. His works include: *Labour Politics* (1903), *India* (1909), and *After Twenty Years: all about the Independent Labour Party* (1913). Cf. W. Stewart, *James Keir Hardie.*

Harding, Warren Gamaliel, President of the United States, born near the village of Blooming Grove, Morrow County, Ohio, on 2nd Nov., 1865. Educated at the school of Blooming Grove and at a college in Caledonia, he was a schoolmaster for some time, but in 1884 he acquired *The Marion Star*, a local newspaper, and subsequently became president of the Harding Publishing Company. Member of the Ohio Senate from 1899 to 1903, Lieutenant-Governor of the state of Ohio from 1904 to 1906, he was elected to the United States Senate in 1914. A political opponent of President Wilson, he supported the candidacy of C. E. Hughes for the presidency in 1916. When the European War broke out, Harding backed up Roosevelt when the latter tried to urge President Wilson to join the Allies and to send troops to Europe. Nominated for the presidency in June, 1920, Harding was elected, by a vast majority, against Cox, the Democratic candidate, on 2nd Nov., 1920. Although he had opposed President Wilson's scheme of the League of Nations, he was nevertheless indefatigable in his endeavour to bring about a new Union, or Association, enabling his country to work hand in hand with the European Powers and to establish a permanent peace. In 1921 he convened a conference of European and American statesmen at Washington for the purpose of discussing and settling the question of disarmament. He died in August, 1923.

Hardinge (hȧr′ding), Henry, Viscount, English commander, was born in 1785, and died in 1856. He was a son of the Rev. Henry Hardinge, rector of Stanhope, Durham. In 1799 he was gazetted ensign, and was present at all the great battles and sieges in the Peninsula. He lost his left hand at the battle of Ligny, became member of Parliament for Durham in 1820, was made Secretary-at-War, Secretary for Ireland, and in 1844 succeeded Lord Ellenborough as Governor-General of India. Being forced into war by an invasion of Sikhs, he took a command under Lord Gough, and, after the great battles of Mudki, Ferozeshah, and Sobraon, dictated a peace in the Sikh capital of Lahore. As a reward for his services he was created Viscount Hardinge and received a pension of £3000. In 1852, on the death of the Duke of Wellington, he succeeded to the post of commander-in-chief. In 1855 he was made a field-marshal.

Hardness, the property of matter in virtue of which solids resist penetration by other solids. It is an essential property in such things as steel punches, ball-bearing surfaces, and armour plate. Methods of measuring hardness are based on (*a*) scratching the surface with a diamond, or with a graded series of substances, as in Mohs' scale employed by mineralogists; (*b*) measuring the height of the rebound of a small ball or hammer from the test surface, which is the principle of the scleroscope; (*c*) measurement of the indentation caused by the fall of a steel mass from a given height, or by the steady pressure of the mass against the test material, as in Unwin's and Brinell's methods. In the latter, a hardened steel ball 1 cm. in diameter is forced into a flat surface of the material under a pressure of 3000 Kgm. The number specifying the hardness is obtained by dividing the total pressure by the curved area of the depression. The hardness of steel is increased when it is suddenly cooled from a high temperature, and when the material is strained beyond the elastic limit.

Hardoi, a town of India, administrative headquarters of Hardoi district, Oudh, 63 miles from Lucknow. Pop. 13,855.

Hardouin (ȧr-dö-aṇ), Jean, a learned French Jesuit, born 1646, died 1729. In his work *Chronologia Veteris Testamenti* (1697) he maintained the extraordinary hypothesis that all the writings under the names of the Greek and Roman poets and historians, except those of Homer, Herodotus, Cicero, and Pliny the Elder, the *Satires* and *Epistles* of Horace, and the *Georgics* of Virgil, are the spurious productions of the thirteenth century, written by monks under the direction of one Severus Archontius.

Hardwar (*Haridwara,* gate of Hari), a town of India, in Saharanpur district, in the United Provinces. It is situated on the Ganges, and is one of the principal places of Hindu pilgrimage, and of the ceremonial of bathing in the sacred river. The town, originally known as Kapila, is of great antiquity and has interesting ruins. Pop. 26,179.

Hardy, Thomas, O.M., LL.D.(Aberdeen), Litt.D.(Cambridge), and D.Litt.(Oxford), novelist, born in Dorsetshire, England, 1840. He served an apprenticeship as an ecclesiastical architect; published his first novel, *Desperate Remedies*, in 1872, and has since written a series of famous novels. Among his best-known works are: *Far from the Madding Crowd, The Hand of Ethelberta, The Trumpet Major, The Woodlanders, The Return of the Native, The Mayor of Casterbridge, Tess of the D'Urbervilles, Jude the Obscure, The Pursuit of the Well-Beloved, The Dynasts, Time's Laughing-stocks, A Changed Man, Satires of Circumstance,* and *Moments of Vision.*—Cf. H. Child, *Thomas Hardy.*

Hare, Sir John, British actor-manager, was born in 1844, and educated at Giggleswick Grammar School, Yorkshire. He first appeared on the stage in Liverpool in 1864, and began his acting career in London in the following year. He acted for ten years with the Bancrofts, and soon made his mark, especially in the plays of T. W. Robertson, though he also acted in the plays of Sheridan and Goldsmith. In 1875 he became manager of the Court Theatre, and joint-manager (along with Kendal) of St. James's Theatre in 1879. The Garrick Theatre was built by Sir W. S. Gilbert for Hare in 1889, and opened with Pinero's *Profligate.* Here he also produced *The Notorious Mrs. Ebbsmith,* and in 1890 had a remarkable personal success in Sydney Grundy's *A Pair of Spectacles,* where he took the part of Benjamin Goldfinch. He enjoyed another triumph when playing the title rôle of Pinero's *Gay Lord Quex* in 1899. He toured in America with great success. He was knighted in 1907. He died 28th Dec., 1921.

Hare, Julius Charles, an English writer on theological and social subjects, born in 1796, died 1855. He was educated at the Charterhouse, and Trinity College, Cambridge. In 1832 he became rector of Herstmonceaux, in 1840 was appointed Archdeacon of Lewes, in 1851 obtained a prebend in Chichester Cathedral, and in 1853 became one of her majesty's chaplains. In concert with his brother, Augustus William Hare, he published a well-known work entitled *Guesses at Truth by Two Brothers.* His other writings include several volumes of sermons; a *Memoir of John Sterling,* prefixed to a collection of his writings; and a *Vindication of Luther against his Recent English Assailants.*

Hare, the common name of rodent mammals of the genus Lepus, with long ears, long hind-limbs, a short tail, soft hair, and a divided upper lip; its dental formula is:

$$\text{I.}\,\frac{2-2}{1-1},\ \text{C.}\,\frac{0-0}{0-0},\ \text{P.M.}\,\frac{3-3}{2-2},\ \text{M.}\,\frac{3-3}{3-3} = 28;$$

the two fore-feet have five and the hinder four toes. The soles of the feet are hairy, and there is a patch of hair on the inner surface of each cheek. They run by a kind of leaping pace. The females produce litters of three to six about four times a year. The young leverets have their eyes open at birth. The common hare (*L. europæus*) is found throughout Europe and some parts of Asia. It is tawny red on the back and white on the belly, and is about 2 feet long. The mountain hare or variable hare (*L. variabilis*), confined to Northern Europe and the mountainous regions of the south, is smaller than the common hare, and becomes white in winter. *L. cunicŭlus* is the rabbit, properly so called, distinguished by its smaller size and burrowing habits. (See *Rabbit.*) The American hare (*L. americanus*), not much larger than a rabbit, is found in most parts of North America. In North America there are also the polar hare, a variety of the variable hare (*L. variabilis*), but of superior size and purer colour; and the prairie hare (*L. campestris*), one of the species known as jackass hares or jack-rabbits, from their size and length of limb. The hare, which has no courage and little cunning, is protected from its enemies mainly by the acuteness of its sight and hearing and its extraordinary swiftness of foot. Its voice is never heard except when seized or wounded, when it utters a sharp loud cry, not very unlike that of a child. Its flesh is rather dry, but is much prized for its characteristic flavour.

Mountain Hare (*Lepus variabilis*) in Winter

Harebell, or **Hairbell,** the Scottish Bluebell (*Campanŭla rotundifolia*), a plant of the nat. ord. Campanulaceæ, common on dry and hilly pastures, by roadsides, &c., in most districts of Europe, with a bell-shaped, blue (sometimes white) flower. The radical leaves are cordate or reniform, the stem-leaves partly ovate or lanceolate, partly linear. Its slender stem is from 4 to 6 inches high, and bears sometimes a single flower, but more commonly more than one, in a panicle.

Har′eld (*Harelda glacialis*), the long-tailed duck, an oceanic duck having a short thick bill, a high forehead, and two very long feathers in the tail of the male, whilst the females have the tail short and rounded. It inhabits the northern seas, and is frequent in Orkney and Shetland, where it is known as the calloo. During the winter it ranges to the Mediterranean, Central Asia, China, Japan, and the Central United States.

Hare-lip, a malformation consisting in a fissure or vertical division of the upper lip, on one or both sides of the middle line of the lip, sometimes extending also to the palate. Children are frequently born with this malformation, and the cleft is occasionally double. It is due to the fact that in the embryo the upper lip is formed of three segments, a median and two lateral, which normally fuse to form a continuous band; but if anything interferes with this normal process, one or both of the lateral pieces may remain separated by a cleft from the central process. The name is given from the imagined resemblance which the part has to the upper lip of a hare. The cure of hare-lip is performed by cutting off quite smoothly the opposite edges of the fissure, and then bringing them together and maintaining them in accurate apposition till they have firmly united.

Ha'rem, or **Hareem'** (Ar., the prohibited), is used by Mohammedans to signify the women's apartments in a household establishment, forbidden to every man except the husband and near relations. The custom of setting aside a special apartment for women is an Oriental idea much older than Islam. It existed in Babylonia, where woman was also called *kharimtū*, and in Persia. But it was Islam which raised the harem to an institution rigidly maintained in the East. In Turkey and in India the women of the harem enjoy more liberty than in other Mohammedan countries. The women of the harem may consist simply of a wife and her attendants, or there may be several wives and an indefinite number of concubines or female slaves, with black eunuchs, &c. The greatest harem is that of the Sultan of Turkey. The women of the imperial harem are all slaves, generally Circassians or Georgians. Their life is spent in bathing, dressing, walking in the gardens, and witnessing the voluptuous dances performed by their slaves. The women of other Turks enjoy the society of their friends at the baths or in each other's houses, and appear in public accompanied by slaves and eunuchs; but the women of the Sultan's harem have none of these privileges. It is, of course, only the richer Moslems who can maintain harems; the poorer classes have generally but one wife. The harem, however, is no longer what it used to be, and under the influence of Western civilization it is gradually becoming modified.—BIBLIOGRAPHY: E. W. Lane, *Manners and Customs of the Modern Egyptians*; A. van Sommer and Zwemer, *Our Moslem Sisters*; W. M. Ramsay, *Everyday Life in Turkey*; P. Loti, *Les Désenchantées*.

Hare's Ear (Bupleurum), a plant of the nat. ord. Umbelliferæ. The most common British species (*B. rotundifolium*) flourishes best on a chalky soil. Under the name of *thorough-wax* it was at one time used as a vulnerary.

Harfleur (ȧr-*fleur*), a town, France, department of Seine-Inférieure, on the Lézarde near its entrance into the Seine, 6 miles east of Havre, once the chief port at the mouth of the Seine. Pop. about 3320.

Hargreaves (hȧr'grēvz), James, English inventor, author of two important improvements in the art of cotton-spinning, was born near Blackburn about 1720, died 1778. In 1760 he invented a machine for carding, and some years after the spinning-jenny, by which he was able to spin with several spindles at once. Suspecting that he employed machinery, his neighbours broke into his dwelling and destroyed his machine; and on the repetition of this kind of persecution Hargreaves removed in 1768 to Nottingham. In 1770 he obtained a patent for his invention, but it was after all declared invalid on the ground that he had sold several of the machines before taking out the patent. For the rest of his life he carried on business as a manufacturer.

Har'icot. See *Bean.*

Harington, Sir John, English writer, born 1561, died 1612. At his baptism Queen Elizabeth stood sponsor. In 1596 he was excluded from court on account of his book *The Metamorphosis of Ajax* (written in the manner of Rabelais), but was soon allowed to return. His best-known performance is, perhaps, his translation of *Orlando Furioso* in heroic verse.

Harîri, Abu Mohammed el Kasim Ben Ali, surnamed El Harîri, or the silk merchant (his father's occupation), a celebrated Arabic scholar and poet, who lived chiefly at Bassorah in the time of the Abbasside caliphs, born A.D. 1054, died 1121 or 1123. He is best known by his *Makâmmât*, a collection of tales narrated as incidents in the life of the hero Abu Zeid, a clever impostor who adopts every career in life; and succeeds in all to admiration. There are many editions and translations of the *Makâmmât*. English translations appeared in 1850 (by T. Preston), in 1867, and in 1898 (by T. Chenery and F. Steingass).

Harlaw', Battle of, in Scottish history, a battle, fought on 24th of July, 1411, which delivered the Lowlands from a Highland invasion and the fear of Highland supremacy. Donald, Lord of the Isles, having collected an army 10,000 strong, threatened to overrun all Northern Scotland, and ravaged the country until he was met at Harlaw, on the Urie, in Aberdeenshire, by a much inferior Lowland force under the Earl of Mar. The battle resulted in the defeat of Donald, although many of the

Lowland gentry, the Provost and chief magistrates of Aberdeen, and a large number of men fell on the field.

Harlebeke, or **Haerlebeke** (här'le-bā-ke), a town in Belgium, in West Flanders, on the Lys. It is said to be the oldest town in Flanders, and has a beautiful parish church, and a pulpit regarded as a masterpiece of carving. Pop. 7450.

Harleian Library. See *Harley.*

Harlequin (Fr. *arlequin*; It. *arlecchino*), a conventional personage in pantomime. On the Italian stage he is a comic character full of drolleries, tricks, and knaveries, and somewhat resembles the English clown. The harlequin of British pantomimes is quite different. He is supposed to be the lover of the columbine, and possesses a wonder-working wand, with which he protects his mistress against the clown and pantaloon, who pursue and endeavour to capture her, until the pursuit is brought to a termination by a good fairy. The harlequin wears a tight dress of bright colours, and glittering with spangles. See *Pantomime.*—BIBLIOGRAPHY: R. J. Broadbent, *A History of Pantomime*; M. Sand, *History of the Harlequinade.*

Harlequin Duck (*Cosmonetta histrionica*), a species of duck, so called on account of its particoloured plumage of white, grey, and black. It inhabits the Arctic regions, and during the winter ranges south to Japan and the United States, more rarely to Britain. In length it is about 17 inches.

Harley, Robert, Earl of Oxford, English statesman, born 1661, died 1724, the son of Sir Edward Harley. After the accession of Anne he and his colleague St. John, afterwards Lord Bolingbroke, became leaders of the Tories. Harley was chosen Speaker of the House of Commons in 1702 under Rochester, and in 1704 was appointed Chief Secretary of State, but resigned in 1708. After the fall of Marlborough Harley became Chancellor of the Exchequer in 1710, and next year was created Earl of Oxford. He and Bolingbroke secured the Treaty of Utrecht (1713), but afterwards quarrelled. Early in the reign of George I he was impeached of high treason on the ground of his alleged Jacobite intrigues. He was kept in the Tower for two years, but, owing to the inability of the Peers and the Commons to agree about the mode of procedure, he was acquitted. His patronage was extended to Swift, Pope, and other literary men, and he made a valuable collection of books and MSS., which latter are preserved in the British Museum, where they form the Bibliotheca Harleiana. Those which have been printed constitute the *Harleian Miscellany.*—Cf. Burnet, *History of his Own Times.*

Harlingen (hȧr'ling-en), a seaport of Holland, province of Friesland, intersected by numerous canals. It has great trade with England in corn, cattle, and butter. Pop. 10,574.

Harmat'tan, a hot and dry wind, which, coming from the interior of Africa, prevails at times on the coast of Guinea in December, January, and February. Under its influence vegetation withers, and the grass becomes like hay. It is similar to the simoon of Egypt and the sirocco of Italy and Malta.

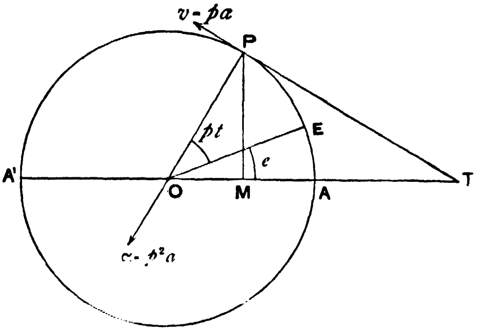
Harmo'dius. See *Aristogeiton* and *Hippias.*

Harmon'ica, Benjamin Franklin's name for a musical instrument constructed with glasses of different sizes, revolving by means of mechanism worked by the foot, and played upon by touching the rim of the glasses with the moistened finger. It constituted the 'musical glasses' of Goldsmith's era. The instrument, known in the seventeenth century, was improved by an Irishman, Richard Pockrich, and still more developed by Franklin. The name is now usually applied to an instrument consisting of a series of glass keys played by two small hammers.

Harmonical Progression, in algebra, a series of numbers the reciprocals of which are in arithmetical progression. The simplest A.P. is the series of natural numbers, 1, 2, 3, 4, . . .; and the simplest H.P. the series of reciprocals of these 1, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, . . . (see *Harmonics*). An arithmetical progression can be *summed,* i.e. a formula can be given for the sum of n terms. To sum the first n natural numbers, e.g., write the series in reverse order and add the result to the original series term by term. We get $(1 + n) + \{2 + (n - 1)\} + \{3 + (n - 2)\} + \ldots$ i.e. $(n + 1) + (n + 1) + (n + 1) + \ldots$ to n terms or $n(n + 1)$. Hence the sum $1 + 2 + \ldots + n$ is $\frac{1}{2}n(n + 1)$. There is no simple formula, however, for the sum of n terms of an H.P. See *Harmonic Range.*

Harmonic Analysis, a mathematical method much used in the solution of advanced physical problems. In these problems the data are not often expressed in a form immediately amenable to mathematical treatment. The given functions have first to be resolved by analysis into their harmonic components, somewhat after the manner in which a complex sound is resolved by the ear (see *Fourier Series*). The suitable harmonic components are by no means always sines and cosines of multiples of a variable; these sines and cosines are sometimes called *simple* harmonic functions. For harmonic functions of other types see *Laplace's Equation.* For an arithmetical method of resolving a function given graphically into its simple harmonic components, see *Vibrations*; *Waves.* — Cf. G. A. Gibson, *Introduction to the Calculus.*

Harmonic Motion, any oscillatory or reciprocating motion. The phrase is also used as equivalent to ***simple harmonic motion***, which is the motion of a point M in a straight line A′OA, when OM = OA$\cos(pt + e)$; t being the time and p, e, constants. Draw the circle on A′A as diameter (fig.). Suppose a point P to move counterclockwise round the circumference so that the angular velocity of the radius OP is uniform, and equal to p radians per second. If we count time in seconds from the moment when P is at E, where angle AOE is e radians, then angle EOP is pt radians. Draw PM perpendicular to A′A; then OM = OPcosMOP = OA$\cos(pt+e)$; the motion of M is therefore simple harmonic. If OM = x, OA = a, then $x = a\cos(pt + e)$. In this equation x is called the *displacement*, a the *amplitude*, e the epoch, and $pt + e$ the *phase*. The *period* T is the time taken to describe 2π radians at angular speed p, or $T = 2\pi/p$. Here T is the time taken for the point M to move from one end of its range to the other and back; so that it is the time of a *complete oscillation* or *double vibration*, or *swing-swang*. The period of a pendulum which beats seconds is thus two seconds.



The *velocity* of M is the horizontal component of the velocity of P, i.e. $- v\cos$OTP or $- pa\sin(pt + e)$. The *acceleration* of M is the horizontal component of the acceleration of P, i.e. $\alpha\cos$MOP, or $p^2a\cos(pt + e)$, *towards* O. These expressions for the velocity and acceleration of M can also be found at once by differentiating the equation $x = a\cos(pt + e)$. From the value found for the acceleration of M, there follows the characteristic property of S.H.M. viz. that the *ratio of acceleration to displacement is constant*, its value being p^2 or $4\pi^2/T^2$. It follows conversely that motion of a material particle in a straight line under a force which is directed towards a fixed point in that line, and the magnitude of which is in a constant ratio to the distance of the particle from that point, is simple harmonic; also, if μ is the value of the constant ratio, then $\mu = 4\pi^2/T^2$, or $T = 2\pi/\sqrt{\mu}$. We have thus the remarkable property that the period, for a given ratio μ, is independent of the amplitude. This is the principle of the *isochronism of vibrations*. For examples see *Kinetics*; *Pendulum*.

Two S.H.M.'s of the same period, and in the same line, can be compounded into a single S.H.M. of that period; for $a\cos(pt + e) + a'\cos(pt + e')$ can be expressed in the form $A\cos(pt + E)$. Two S.H.M.'s of the same period, but in different lines, give a resultant motion which may be rectilinear, circular, or elliptic. The case of a circular resultant motion is important in physical optics (circular polarization of light), and in electrical engineering (rotating magnetic field). It arises when the rectangular components of a plane vector are $x = a\cos(pt + e)$, $y = a\sin(pt + e)$, so that the phases of the components differ by 90°. A figure shows at once that the vector is of constant magnitude a, and that its direction makes an angle $pt + e$ with the axis of x, so that the vector rotates with constant angular velocity p.

Any oscillatory rectilinear motion of period T can be analysed into simple harmonic components of periods T, $\frac{1}{2}$T, $\frac{1}{3}$T, &c. In other words, any function x of the time, of period T, can be expressed in the form

$$x = a_0 + a_1\cos(2\pi t/T + e_1) + a_2\cos(4\pi t/T + e_2) + a_3\cos(6\pi t/T + e_3) + \dots$$

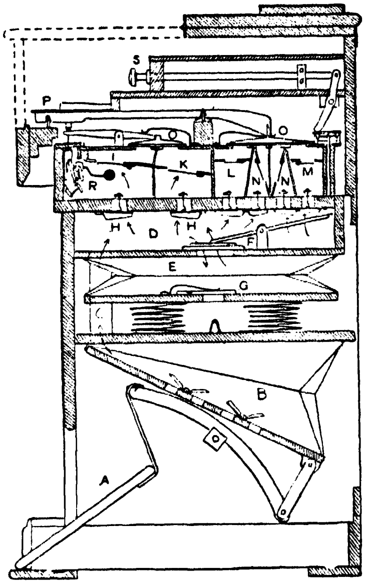
(see *Fourier Series*). Cf. Kelvin and Tait, *Natural Philosophy*.

Harmonic Range, in geometry. If a line AB is divided internally and externally in the same ratio at C and D, the four points are said to form a harmonic range. AB is cut in *harmonic section* at C and D; and CD is cut in harmonic section at A and B. If the four points are joined to any point O not in line with them, the four lines, or *rays*, OA, OB, OC, OD are said to form a *harmonic pencil* (see *Geometry*). When AB is divided harmonically at C and D, the distances (taken with proper sign and in proper order) of any one of the points A, B, C, D from the other three are in harmonical progression (q.v.). Thus, e.g., we have AC : CB = AD : BD; from which it is easy to deduce that 1/AC − 1/AB = 1/AB − 1/AD.

Harmonics, the system of simple tones given out by a vibrating body; or these tones with the exception of the gravest, which is called the fundamental. The vibrator may be any elastic solid or fluid; but, for the production of musical sound, it is usually either a stretched string, as in the violin and piano, or an enclosed volume of air, as in the organ and other wind instruments. When a string fixed at its two ends is vibrating in its fundamental mode, there is no fixed point, or node, between the ends. In the harmonic modes certain points of the string do not move during the vibration—the mid-point in the first harmonic mode, the two points of trisection of the string in the second mode, and so on. If the period of the fundamental be taken as 1, then the periods of the harmonics are $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, &c. This relation is the origin of the name *harmonical progression* (q.v.) in algebra. A relation of exactly this form holds for the *longitudinal* and for the *torsional* vibrations of a rod. In an organ pipe, also, the law of succession of the harmonics is practically of this type, but two cases have to be considered separately. When both ends are open, the frequencies of fundamental and overtones are, as in the case of the string, in the ratios of the natural numbers 1, 2, 3, 4, &c.; but when one end is open and the other closed, the frequencies are as the *odd* numbers 1, 3, 5, &c. For the *flexural* vibrations of a rod or bar, the law of periods is more complicated; for a bar free at both ends, the frequencies are (approximately) as $3^2 : 5^2 : 7^2$, &c.; for a bar clamped at one end and free at the other, the first three frequencies are nearly as $1 : 6{\cdot}25 : 17{\cdot}5$—a tuning-fork may be regarded as an example of this type. For a few bodies of more complex shape (e.g. a thin plate and a solid sphere) the law of periods can be found theoretically. For bodies in general the chief harmonics can be found by experiment (see *Resonance*). Well-made bells give out three prominent notes—the fundamental, the 'nominal' (an octave higher), and the 'hum-note' (an octave lower). The best form for bells has been found by trial, not by theory. A body taken at random is much more likely to give out a discordant than a harmonious sound. Two simple tones only concord with one another if their frequencies are in the ratio of two small whole numbers. For an interval of an octave the frequencies are as 2 : 1; for a fifth, 3 : 2; fourth, 4 : 3; major third, 5 : 4; minor third 6 : 5. Hence, in a vibrating string or organ-pipe, the lower harmonics, which are the strong ones, satisfy the condition for harmony. See *Scale*; *Music*; *Acoustics*; *Resonance*; *Waves*.

Har′monists, or **Harmony Society,** a religious sect founded at Würtemberg about the year 1788 by two brothers called George and Frederick Rapp. They endeavoured to re-establish the social practices of the early Christian Church, encouraged celibacy, held all their goods in common, and taught the second advent. Persecuted by their countrymen, the followers of Rapp emigrated to America, and established themselves (1805) successfully at Harmony, in Pennsylvania. They afterwards migrated to Indiana, but this venture not proving successful, they sold their land at New Harmony to Robert Owen, the Socialist, and finally settled at a place which they named Economy, 17 miles from Pittsburg. George Rapp died in 1847, but the Society continued to exist until 1906, when it was formally dissolved.

Harmo′nium, a musical instrument of modern invention, producing sounds somewhat resembling those of the organ, resulting from the pressure of wind on a series of vibrating metallic reeds. By the action of bellows, to which the feet communicate a more or less rapid movement, the air is made to impinge against thin tongues of metal (here termed *reeds*), and to set them vibrating. These metal tongues are fitted into a slit in the top of a small box or sonorous cavity, called a wind-box, and are enabled to vibrate by being fixed only at one end. The discovery that the form of the wind-boxes determines the quality of the sound produced by the vibration of these metallic tongues contributed very much to the development of the harmonium, as it enabled the player to imitate the sound of the oboe, flute, &c. The instrument has a key-board like that of a piano,



Harmonium

A, Treadle actuating feed-bellows. B, C, Wind-trunk. D, Wind-chest. E, Reservoir to which wind is admitted by the valve F, which is normally open, but is closed when the expansion stop is drawn. G, Discharge pallet to prevent overblowing. H, H, &c., Set of valves each actuated by a draw-stop. I, K, L, M, N, Vibrating reeds giving the musical sounds (I, Flute. K, Clarionet. L, Fife. M, Oboe. N, Vox celeste, two ranks, one tuned slightly sharp, the other slightly flat). The space above the reeds is divided into narrow channels, one to each reed, the wind escaping through the pallets O, O, when opened by depressing the keys P, thus setting the reeds vibrating. R, Percussion action to secure quick response. The mechanism of the draw-stop S is not shown.

and when one of the keys is pressed down a valve is opened, which allows the wind from the bellows to rush through one of the wind-boxes and act on the vibrator. There are several stops, by means of which the performer can direct the stream of wind into the wind-boxes which produce a flute, clarionet, or any other sound. There is also a knee action, which either serves as an expression stop, or brings all the stops of the instrument into play at once, and what is called the percussion action, which consists in the application of a small hammer, which strikes the vibrator as soon as the key is pressed down, and thus aids the action of the wind. The better makes of harmoniums have now usually two or more extra rows of vibrators, which, acted upon by separate stops, add so many octaves to the compass.

Harmony. See *Music*; *Counterpoint.*

Harmony, Evangelical, or Harmony of the Gospels, the title of works written with a view to prove the substantial agreement of the four Evangelists. The heretic Tatian composed in the second century the *Diatessaron*, the first work of this kind, a continuous narrative of the events written in the Gospels. From this harmony all passages were omitted which favoured the doctrine of the real humanity of Christ, and hence told against the peculiar doctrines of Tatian. Theophilus of Antioch is said to have composed a book of a similar kind, and Ammonius Saccas (died A.D. 243) executed another *Diatessaron*, with the corresponding passages arranged in parallel columns. The *Ten Indexes* of Eusebius probably appeared in the first half of the fourth century, and was more complete than its predecessors.

Harmony of the Spheres, an hypothesis of Pythagoras and his school, according to which the motions of the heavenly bodies produced a music imperceptible by the ears of mortals. He supposed these motions to conform to certain fixed laws, which could be expressed in numbers corresponding to the numbers which give the harmony of sounds.—Cf. *Merchant of Venice*, v, 1, 60.

Har′motome, or Cross-stone, a mineral hydrous silicate of potassium, barium, and aluminium. It crystallizes in the monoclinic system, usually in quadruplets formed by the interpenetration of two twin crystals at right angles to one another, so that the cross-section is cruciform. Its colour is usually white, but may be yellow, red, or brown; it is translucent or semi-transparent, with a somewhat pearly lustre, and is nearly as hard as glass. Harmotome is a member of the zeolite group.

Harnack, Adolf, German theologian, son of a Lutheran theological professor, born in 1851 at Dorpat. He became extraordinary professor in Leipzig in 1876, ordinary professor in Giessen (1879), Marburg (1886), and Berlin (1889). Harnack is the most prominent leader of a notable neo-Ritschlian movement in German theological thought, and has exercised great influence outside his own country. His principal works, many of them available in English translations, are: *Martin Luther*; *Lehrbuch der Dogmengeschichte*; *Das Mönchtum, seine Ideale und seine Geschichte*; *Grundriss der Dogmengeschichte*; *Das apostolische Glaubensbekenntnis*; *Texte und Untersuchungen zur Geschichte der altchristlichen Litteratur*; *Das Wesen des Christentums*; and *Essays and Addresses*. His works, notably those on the *Apostles' Creed* and the *Essence of Christianity*, have called forth violent opposition from Prussian orthodoxy. Other works are: *Die Mission und Ausbreitung des Christentums in den ersten drei Jahrhunderten*, *Beiträge zur Einleitung in das neue Testament*, &c. In 1905 he gave up his Berlin chair in order to become director of the Royal Library.

Harness, the various articles which are required to yoke a horse or another animal to any vehicle, or to control and suit them for any kind of work. See *Bit*; *Bridle*; *Saddle*; &c.

Harold (or Harald) I, *Haarfager* (Beautiful-haired), King of Norway, one of the greatest monarchs of that country, succeeded his father in A.D. 863. He brought all the Norwegian jarls under his power, and completely subjected the country, allowing his hair to remain uncut for twenty years until he attained this object (885). Of the conquered jarls, Hrolf, or Rollo, emigrated to Neustria (France); others established themselves in Iceland, the Shetland Isles, the Faroes, and the Orkneys. In consequence of their incursions into his dominions, Harold embarked with a naval force to subdue them, and having conquered the Orkneys, &c., returned home. He fixed his residence at Trondhjem, and died there in 933.

Harold III (*Hardrada*, the Hardy), King of Norway, the son of Sigurd, a descendant of Harold Haarfager. In his youth he went to Constantinople, joined the Varangian Guard, and took part in the expedition to Italy and Sicily against the African pirates. He was ultimately appointed commander of the imperial body-guard, and defeated the Saracens. About 1042 he returned to Norway, after having, on his way through Russia, married the daughter of the Grand-Duke Jaroslav. In 1047 he succeeded his nephew, Magnus the Good, as sole King of Norway. In 1066 he joined Tostig, the brother of Harold II of England, in an invasion of that country, but was defeated and slain at the battle of Stamford Bridge. See *Harold II.*

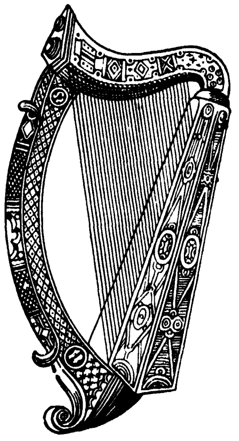
Harold I, surnamed *Harefoot*, Danish King of England, succeeded his father Canute in 1035 as king of the provinces north of the Thames, and became king of all England in 1037. His countrymen, the Danes, maintained him upon the throne against the efforts of Earl Godwin in favour of Hardicanute; and Harold eventually gained the earl over. After a reign of four years Harold died in 1040.—Cf. Sir C. W. Oman, *History of England before the Norman Conquest.*

Harold II, King of England, born about 1022, was the second son of Godwin, Earl of Kent. On the death of Edward the Confessor, 5th Jan., 1066, he stepped without opposition into the vacant throne, without attending to the claim of Edgar Atheling, or the alleged bequest of Edward in favour of the Duke of Normandy. The latter immediately called upon him to resign the crown, and upon his refusal prepared for invasion. He also instigated Harold's brother, Tostig, to infest the northern coasts of England in conjunction with the King of Norway. (See *Harold III.*) The united fleet of these chiefs sailed up the Humber, and landed a numerous body of men, but at Stamford Bridge, in Yorkshire, were totally routed by Harold, whose brother Tostig fell in the battle. Immediately after he heard of the landing of the Duke of Normandy at Pevensey, in Sussex. Hastening thither with all the troops he could muster, a general engagement ensued at Senlac, near Hastings, 14th Oct., 1066, in which Harold was slain, and the crown of England passed to William.—Cf. E. A. Freeman, *The Norman Conquest.*

Haroun al Raschid. See *Harun al Rashid.*

Harp (A.Sax. *hearpe*, Lat. *harpa*, Fr. *harpe*), a stringed instrument of great antiquity, found among the Assyrians, Egyptians, Hebrews, Greeks, Irish, Welsh, and other nations. Its variety of form and construction was only equalled by its universality. The modern instrument is well known: its form is nearly triangular, and the strings distended from the upper part to one of the sides. It stands erect, and is played with both hands, the strings being struck or pulled with both fingers and thumbs. The instrument in its ancient forms was very defective. Egyptian harps are represented with four, seven, ten, twenty, or more strings, but we have little idea of the scale to which they were tuned. The frames are depicted as being curved in various forms, and the front pillars are wanting. The harps of the Hebrews were probably similar to the Egyptian instruments. It is probable that the various Celtic harps were derived from some Oriental pattern. Among the Anglo-Saxons the harp was a favourite instrument. The harp was held in great honour among the Celtic bards. It is still in use in Wales, although it has disappeared in the Highlands of Scotland. The modern harp was by no means an efficient instrument, until pedals were invented, an invention finally perfected by Sebastian Erard, whose patent was taken out in 1795. In 1810 he patented a double-action harp with seven pedals, each effecting two changes in the pitch of the strings. The harp thus constructed contains forty-three strings tuned according to the diatonic scale, every eighth string being a replicate in another octave of the one counted from.—BIBLIOGRAPHY: article in Grove's *Dictionary of Music and Musicians*; W. H. Grattan-Flood, *The Story of the Harp.*

Egyptian Harps


Irish Harp

Harpe. See *La Harpe.*

Harpenden, an urban district of England, Herts, 5 miles south-east of Luton, the seat of laboratories, experimental fields, &c., established by Sir John Bennet Lawes for the furtherance of agriculture, and made over for public use. Pop. 6738.

Harper's Ferry, a village, United States, West Virginia, on the Potomac, at its junction with the Shenandoah, and formerly a United States depot of military stores. It is famous as the scene of the unsuccessful rising headed by John Brown with a view to destroying slavery (16th Oct., 1859). The rising was suppressed, and Brown was executed. Harper's Ferry is the seat of Stover College for coloured students. Pop. 706.

Harpies, the ancient Greek goddesses of storms. Their parentage, ages, appearance, names, and number are very differently given by the poets. In the Homeric poems they are ministers of untimely death, ' snatchers ', and personifications of the angry winds. Hesiod represents them as two young virgins of great beauty called Aëllo and Ocypete, daughters of Thaumas and Electra, and sisters of Iris. The later poets and artists vied with each other in depicting them under the most hideous forms, covered with filth and polluting everything in contact with them. They are often represented as having female faces.

Harpy, from a Tomb in the British Museum

Harp-shell, the shell of a genus (Harpa) of sea-snails constituting a special family (Harpidæ). The species are found more especially at the Mauritius. The shells are very beautiful, but exposure to light causes their colours to fade.

Harp'sichord (O.Fr. *harpechorde*, Fr. *clavecin*), a keyed, stringed instrument formerly in use, in appearance and construction similar to a grand pianoforte. In the front the keys were disposed, the long ones being the naturals, and the short ones the sharps and flats. These keys being pressed by the fingers, their enclosed extremities raised little, upright, oblong slips of wood called *jacks*, furnished with crow-quill plectrums which struck the wires, instead of the hammers of the modern pianoforte. It is uncertain when the harpsichord was invented, probably in the fifteenth century. It was introduced into England in the seventeenth century.

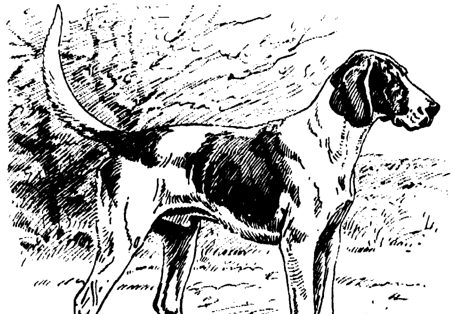
Harpy-eagle (*Thrasaëtus harpyia*), a diurnal bird of prey which inhabits tropical America from Southern Mexico to Southern Brazil. It is extremely powerful, and in total length slightly in excess of the golden eagle. It has, however, a somewhat shorter expanse of wing. Its shoulder muscles possess enormous strength. Its bill is powerful and crooked, and its claws are extremely strong and sharp. The harpy-eagle feeds on birds, sloths, fawns, racoons, &c., as well as on fish, water-snakes, and the eggs of the tortoise.

Harquebuse. See *Arquebus*.

Harrier, a kind of dog employed to hunt the hare. It closely resembles the foxhound, but is smaller in size.

Harrier, the name of several hawks of the genus Circus, allied to the buzzards. They strike their prey upon the ground and generally fly very low. The marsh-harrier, the hen-harrier, and Montagu's harrier are found in Great Britain. The marsh-harrier (*C. æruginōsus*) is from 21 inches to 23 inches long. The hen-harrier (*C. cyanĕus*) is 18 inches to 20 inches long; the adult male is of an almost uniform grey, the female brown. It is very destructive to poultry-yards, whence the name. Montagu's harrier (*C. cineraceus*) is smaller and darker than the last species, but with longer wings. Harriers are found in most parts of the world, and there are over a dozen species besides those mentioned above.

Harrington, James, a celebrated political writer, born 1611, died 1677. Having studied under Chillingworth at Oxford, and travelled on the Continent, he was, on the outbreak of the Civil War, desirous of procuring a reconciliation between the king and Parliament, but his efforts were futile. During the Protectorate he wrote his *Oceana*, which describes an ideal republic, and which was published in 1656. In the reign of Charles II he was imprisoned on a charge



Harrier

of plotting against the Government, but was released on account of the decay of his mental faculties. In addition to the *Oceana* he also published an English translation of four books of the *Æneid.* An edition of his works by Toland appeared in 1700.

Harris, James, an English philologist, born in 1709, died 1780. In 1744 he published a volume containing three treatises—*On Art, On Music and Painting,* and *On Happiness.* His most celebrated work is *Hermes, or a Philosophical Inquiry concerning Universal Grammar* (1751). He was afterwards a member of Parliament, and held important Government offices. In 1775 he published *Philosophical Arrangements,* a work on Aristotle's logic. His concluding work, *Philological Inquiries,* was completed in 1780, but was not published till after his death.

Harris, James Rendel, a distinguished Biblical scholar belonging to the Society of Friends. Educated at Clare College, Cambridge, of which he became a Fellow, he has held professorships at Johns Hopkins University, Baltimore, and Haverford College, Pennsylvania. He was for a time university lecturer in palæography at Cambridge, and from 1903 to 1904 professor of theology in the University of Leyden. From 1903 to 1918 he was director of studies at the Friends' Settlement for Social and Religious Study at Woodbrooke, near Birmingham. He travelled extensively in the East, and was in Armenia at the time of the massacres in 1896, engaged in the distribution of relief. His published works include: *The Teaching of the Apostles* (1887), *The Diatessaron* (1890), *A Study of Codex Bezæ* (1890), *The Apology of Aristides* (1891), *The Newly Recovered Gospel of St. Peter* (1892), *Lectures on the Western Text of the New Testament* (1894), *Union with God* (1895), *Letters from Armenia* (1897), *The Gospel of the Twelve Apostles* (1900), *The Dioscuri in Christian Legend* (1903), *The Guiding Hand of God* (1905), *The Odes and Psalms of Solomon* (1910), *Boanerges* (1913), *The Sufferings and the Glory* (1914), *Origin of the Cult of Apollo* (1915), *Origin of the Cult of Aphrodite* (1916), *Origin of the Doctrine of the Trinity* (1919), *The Last of the Mayflower* (1920).

Harrisburg, a city of the United States, capital of Pennsylvania, 110 miles north of Washington, on the Susquehanna, over which there are three railway bridges besides a bridge for ordinary traffic. It occupies an elevated and commanding site, and has a fine capitol, and State library; and important industries connected with iron and steel, various other industries, and an active trade. Pop. (1920), 75,917.

Harrison, Frederic, English writer on philosophical and miscellaneous subjects, born in London 1831, educated there and at Oxford, was called to the Bar and practised as a conveyancing and equity lawyer, held the professorship of jurisprudence and international law at the Inns of Court (1877–89), was several years an alderman of the London County Council, and has been a parliamentary candidate. He is the chief representative in England of positivism and the religion of humanity. His writings include: *The Meaning of History* (1862, and again 1894); *Order and Progress*; *Social Statics* (a translation from Comte); *Science and Humanity*; *The Present and the Future*; *The Choice of Books, &c.*; *Oliver Cromwell*; *Studies in Early Victorian Literature*; *William the Silent*; *Tennyson, Ruskin, and Mill*; *Byzantine History in the Early Middle Ages*; *Life of Ruskin*; *Theophano* (a historical romance); *The Creed of a Layman*; *The Positive Evolution of Religion*; *The German Peril*; *Obiter Scripta*; and *Novissima Verba.* He died in January, 1923.

Harrison, John, English horologist and inventor, famous as 'Longitude Harrison', was born in Yorkshire in 1693, and died 1776. He was the son of a carpenter, and became an assistant to his father, who was occasionally employed in repairing clocks. An Act of Parliament had been passed in 1714 offering rewards of £10,000, £15,000, or £20,000 for a method of ascertaining longitude within 60, 40, or 30 miles. This Harrison set himself to accomplish, but it was not till 1765 that he was fully successful, the highest award being then allotted him for the invention of his chronometer. He also applied the principle of the different expansibility of metals in his gridiron pendulum, and invented a fusee by which a watch could be wound up without interrupting its movements. Among his writings is *A Description concerning such Mechanism as will afford a Nice and True Mensuration of Time.*

Harrison, a town of the United States, New Jersey, on the Passaic, practically a suburb of Newark. Pop. 14,498.

Har'rogate, a municipal borough of England, county of York, noted for its magnesia, sulphur, and chalybeate springs. The waters are especially recommended for patients with deranged digestive organs, chronic gout, and some cutaneous diseases. The sulphureous springs possess laxative and diuretic properties. The chalybeate are tonic. The bathing season lasts from May to September. Since 1897 the town has been extended in area and greatly improved. Pop. 38,938.

Harrow, an agricultural implement, employed for pulverizing soil, covering in seed, &c. It consists of a frame of woodwork, or of iron, in which are fixed rows of iron teeth. There are several varieties of this implement, or implements serving similar purposes, such as the 'brake' for breaking down rough land; the 'drill harrow' for pulverizing between furrows of green crops; the 'grubber' for breaking up and pulverizing soil before the deposition of seed. Flexible chain-harrows are useful for dragging out couch grass, and for employment on grass-land.

Harrow-on-the-Hill (or simply **Harrow**), a town of England, county of Middlesex, on a hill of peculiar form. The grammar-school of Harrow, the rival of Eton, was founded by John Lyon, in 1571, for the education of the poor children of the parish, certain fees being charged for strangers; but it is now almost entirely a school for the wealthy. The school numbers about 600 boys, and there are eleven houses. The education originally given was exclusively classical, but mathematics, science, English history and literature, modern languages, music, and drawing are now among the subjects taught. The town gives name to a parliamentary division of the county. Pop. 19,468.

Harry (or **Henry**) **the Minstrel,** commonly called *Blind Harry,* a wandering Scottish poet of the fifteenth century, author of a poetical narrative of the achievements of Sir William Wallace, of which there is a complete manuscript of date 1488 in the Advocates' Library. The date of the poem may probably be placed between 1470 and 1480. It professes to be based on Latin histories by John Blair and Thomas Gray, otherwise unknown. It has little or no value as history, and contains impossible incidents, yet recent discoveries have vindicated its accuracy in several particulars once discredited. The modern Scottish version by William Hamilton of Gilbertfield was long a favourite book in Scottish homes. Of the poet we know hardly anything beyond a brief notice in John Major's history (1521), in which he is said to have received food and clothing for reciting his history before the nobles.—Cf. J. Moir, *A Critical Study of Blind Harry.*

Hart, Sir Robert, inspector-general of Chinese customs, born in County Armagh in 1835, died in 1911. Educated at Taunton, Dublin, and Belfast, he entered the British consular service in China in 1854, and in 1859 he accepted an appointment in the Chinese Imperial Maritime Customs, of which he became inspector-general in 1863. He discharged the important and responsible duties of this post with conspicuous ability during a critical period, and his services were recognized by the grant of honorary distinctions from all European countries and from China. He was created K.C.M.G. in 1882, G.C.M.G. in 1889, and was made a baronet in 1893. He retired in 1908. He wrote *These from the Land of Sinim* (1901).

Harte, Francis Bret, American novelist and poet, born at Albany, New York, 1839, died in 1902. He went to California in 1854, and worked successively as a teacher, a miner, and a typesetter on *The Golden Era,* in which appeared some of his earliest literary efforts. He afterwards joined the staff of *The Californian,* to which he contributed the humorous burlesques afterwards published as *Sensation Novels Condensed* (1870). From 1864 to 1870 he was secretary of the United States branch mint in San Francisco, and in 1870–1 held the post of professor of recent literature in the University of California. In 1868 he became editor of *The Overland Monthly,* in which appeared *The Luck of Roaring Camp* (1868), *The Outcasts of Poker Flat* (1869), two of his best short stories, and *The Idyl of Red Gulch,* also the humorous poem of *The Heathen Chinee.* In 1878 he became United States Consul at Crefeld, whence he was transferred to Glasgow in 1880, and remained there until 1885, afterwards making London his residence. His short stories, mostly dealing with the rough western life of former days, include: *Stories of the Sierras* (1872), *Tales of the Argonauts* (1875), *The Twins of Table Mountain* (1879), *An Heiress of Red Dog* (1879), *Jeff Briggs's Love-Story* (1880), *Flip* (1882), *A Drift from Redwood Camp* (1888), *From Sand Hill to Pine* (1900). He was less successful in his novels, among the chief being *Gabriel Conroy* (1876), *In the Carquinez Woods* (1883), *Maruja* (1885), *Snowbound at Eagle's* (1886), *A Waif of the Plains* (1890), and *Three Partners* (1897). He also wrote much verse, comprised in volumes entitled *Poems* (1871), *East and West Poems* (1871), *Echoes of the Foot-Hills* (1874), *Some Later Verses* (1898), and *Under the Redwoods* (1901).

Hartebeest, or **Caama** (här'tė-bāst, kä'mȧ; *Alcelăphus* or *Bubălis caama*), a South African antelope, which measures about 5 feet high at the shoulders, has a long head, horns projecting outwards and backwards, black marks on the face and legs, a white mark on the rump, and a bushy tail. It is generally to be found in small herds.

Hartford, a city of the United States, capital of Connecticut, on the Connecticut River, 50 miles above its mouth. It is pleasantly situated, is built with great regularity, and has among its edifices the handsome white marble capitol, city hall, Trinity College (Episcopal), Roman Catholic Cathedral, the Wadsworth Athenæum, and various asylums. Both manufactures and trade are of large extent, the former embracing cycles, steam-engines, small-arms, and foundry and machine-shop products. It is a great centre of the insurance business. Hartford was settled in 1635 by colonists from Massachusetts. The Hartford Convention of 1814–5 was a meeting of delegates of the New England states occasioned by the war with Britain. Pop. (1920), 138,036.

Hartlepool, a parliamentary borough of England, including the municipal borough of Hartlepool and the county borough of West Hartlepool, in the county of Durham, 17 miles S.E. of the city of that name. The trade and industries of the towns are much of the same character; they possess ironworks, puddling furnaces, brass-foundries, engine- and boiler-works, shipyards, sawmills, and breweries. Extensive fisheries are also carried on. The two towns may be said to form one port. There are spacious docks and a fine pier, serving as a breakwater. Pop. of municipal borough of Hartlepool, 20,961; of West Hartlepool, 68,689. The parliamentary borough, officially designated as 'The Hartlepools', sends one member to Parliament. Hartlepool was already an important harbour in 1171. During the European War the port was bombarded by the Germans on 16th Dec., 1914, and great damage was caused.

Hartley, David, an English physician, principally celebrated as a writer on metaphysics and morals, born 1705, died 1757. He became a Fellow of Jesus College, Cambridge, and finally practised medicine at Newark, Bury St. Edmund's, and in London, and ended his days at Bath. In his *Observations on Man* (1749, 2 vols.) he formulates his hypothesis of nervous vibration and of the association of ideas.

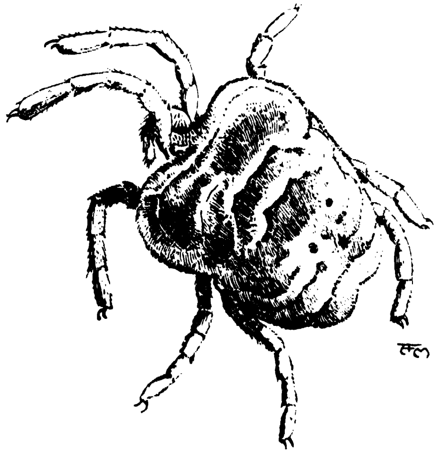
Hartmannsweilerkopf, called by the French Vieil Armand, a summit in the Vosges, near Mulhouse. It was the scene of fierce fighting between the French and the Germans during the European War (Jan. to Dec., 1915).

Hartshorn, in pharmacy, the horn of the common stag, from which substances deemed of high medical value were formerly prepared by distillation, such as spirits of hartshorn, oil of hartshorn, and salt of hartshorn. The active ingredient of these was ammonia, which is now obtained from gas-liquor and other sources. It was the principal remedy used by the heroines of Fielding's and Richardson's novels in their fainting fits.

Hart's-tongue (Scolopendrium), a genus of ferns. Their fronds are simple and undivided. There are about a dozen species known, the *S. vulgāre* being British.

Harun al Rashid (hà-rön′ àl-ra-shēd′; Harun the Orthodox), a celebrated caliph of the Saracens, 786–809, the fifth of the Abbasside caliphs (q.v.). The popular fame of this caliph is evinced by the *Arabian Nights' Entertainments*, in which Harun, his wife Zobeide, his vizier Giaffer, and his chief eunuch Mesrur are conspicuous characters.—Cf. Sir W. Muir, *The Caliphate.*

Harvard University, the oldest university in the United States, situated in Cambridge, Massachusetts. The nucleus of it was formed in 1636 by the voting of a sum of £400 by the general court of Massachusetts. In 1638 the Rev. John Harvard bequeathed half of his property and his entire library to the projected institution. The college was immediately opened, and received the name of its benefactor, and the first graduation occurred in 1642. Its endowments have greatly increased since that time, and its property and funds now amount to over 40,000,000 dollars. The principal college buildings number twenty-five, and include several halls, such as University Hall, Harvard Hall, &c. The libraries contain about 1,940,000 volumes (1919). There are about 782 members of the teaching staff, and the number of students is over 7000. An entrance examination is required in one of two sets of subjects, of which classics predominate in the one, mathematics and science in the other. After the first year's course, which embraces a prescribed series of studies, the student has a large number of different courses to select from in order to qualify for the degree of Bachelor of Arts, the course of study extending to four years. Among the departments connected with the university are: (1) The Law School; (2) The Lawrence Scientific School; (3) The Divinity School; (4) The Medical School; (5) The Dental School; (6) The Bussey Institution of Agriculture; (7) The Veterinary School. We may also mention the Museum of Zoology (the Agassiz Museum), Botanical Garden, Peabody Museum of American Archæology and Ethnology, Fogg Art Museum, Semitic Museum, and Radcliffe College for Women.—BIBLIOGRAPHY: W. R. Thayer, *History and Customs of Harvard University*; J. H. Gardiner, *Harvard.*



Harvest-bug (*Trombidium holosericeum*)
Greatly magnified. Natural size about $\frac{1}{12}$ in. long.

Harvest-bug (Trombidium), the six-legged larvæ of certain mites. They are of a bright red colour, so small as scarcely to be visible, and resemble a grain of cayenne pepper. They appear in June or July, and attack the skin of domestic animals, as horses, dogs, and sheep, under which they burrow, causing red pustules to arise. It attacks the legs, thighs, and lower part of the abdomen of human beings.

Harvester, Harvestman, or **Harvest-spider** (species of Phalangium, Oligolophus, &c.), the popular name of active long-legged arachnids of the ord. Phalangidea. They differ from true spiders by fusion of the abdomen with the cephalothorax.

Harvest-moon, the name given to the moon during that lunation whose full moon is the nearest to the autumnal equinox (23rd Sept. in northern latitudes). For some days before and after her full the moon then rises nearly at the same hour on successive evenings, at about the time of sunset. There is thus a continuity of natural light, and as this facilitated harvest operations, the name 'harvest-moon' was applied. The cause of the phenomenon is that this full moon is situated near the First Point of Aries, and travelling towards the more northern constellations of the zodiac. Her northward motion in declination nearly or quite counterbalances, in higher latitudes, the daily retardation which would else result from her eastward motion in right ascension.

Harvest-mouse (*Mus messorius*), the smallest British mammal, except the lesser shrew, first made known to science by White of Selborne. The body is about 2½ inches long, and the prehensile tail a little shorter. It builds a globular nest usually suspended among stalks of wheat.

Harvest-mouse (*Mus messorius*) and Nest

Harvey, Sir George, a Scottish painter, born 1806, died 1876. He was a native of St. Ninians, near Stirling, and in his eighteenth year entered the Trustees' Academy, Edinburgh. In 1826 he became an Associate of the Royal Scottish Academy, and in 1829 an Academician. He chiefly painted scenes connected with the religious history of Scotland, such as *The Covenanters Preaching, The Battle of Drumclog, Quitting the Manse,* and others, but he was also prominent as a landscape-painter, especially in later life. In 1864 he was elected president of the Royal Scottish Academy, and he was knighted in 1867.

Harvey, Sir John Martin, British actor-manager, was born at Wyvenhoe, Essex, in 1867, and educated at King's College School, London. He originally intended to become a naval architect, but abandoned this idea and studied elocution under John Ryder with a view to going on the stage. He began his career with Clayton and Wyndham, but subsequently joined Sir Henry Irving, and remained many years with him. He has managed the Lyceum, Prince of Wales's, the Court, the Royalty, and the Apollo Theatres. Among his productions are: *The Only Way, Ib and Little Christina, The Breed of the Treshams, The Corsican Brothers, The Faun,* and *Armageddon.* He has also produced many plays of Shakespeare. He was knighted at the New Year, 1921.

Harvey, William, an English physician, the discoverer of the true theory of the circulation of the blood, was born at Folkestone 1578, died 1657. He entered Caius College, Cambridge, in 1593, and about 1599 proceeded to Padua, then the most celebrated school of medicine in Europe, and attended lectures on anatomy, surgery, and other branches of medical science. He took the degree of M.D., and returned to England in 1602. He settled in London, was admitted Fellow of the College of Physicians, elected physician of St. Bartholomew's Hospital, and in 1615 was chosen Lumleian lecturer. His views on the circulation of the blood were formally given to the world in his *Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus* (On the Movement of the Heart and Blood in Animals), published at Amsterdam in 1628, in which he claims to have expounded and demonstrated them for upwards of nine years. Harvey's theory was attacked by several foreign physicians; but from the commencement his views were widely received. In 1623 he was appointed physician extraordinary to James I, and in 1632 he became physician in ordinary to Charles I. He was present at the battle of Edgehill, and afterwards accompanied Charles to Oxford. Here he received the degree of M.D., and was elected Warden of Merton College, an office which he lost on the surrender of Oxford to the Parliament. He returned to London in

1646, and spent the remainder of his life in retirement. Of Harvey's works, the next in importance to the *De Motu* is his *Exercitationes de Generatione Animalium* (On the Generation of Animals; 1651).—Cf. R. Willis, *Life of Harvey.*

Harveyella, a genus of Red Algæ, family Gigartinaceæ. The only species, *H. mirabilis*, is a small colourless parasite growing on another red seaweed, Rhodomela.

Harwich (har′ich), a seaport of England, county Essex, 66 miles E.N.E. of London. The harbour is spacious, and has been much improved by the construction of two breakwaters. Steam packets ply regularly to Continental ports. Shipbuilding and other maritime employments are carried on, and cement is dredged up outside the harbour. Harwich (with Dovercourt) is much frequented by sea-bathers. An important naval base during the European War, Harwich was raided by German air-craft in 1917. Pop. 13,036.

Harwood, Great, a town (urban district) of England, Lancashire, 4½ miles north-east of Blackburn, with cotton manufactures, coal-mines, &c. Pop. 13,596.

Harz, or **Hartz** (hȧrts; Ger. *Harzgebirge*), the *Hercynia Silva* of the Romans, the most northerly mountain chain of Germany, from which an extensive plain stretches to the North Sea and the Baltic. It extends from south-east to north-west, and comprises an extent of about 60 miles in length and nearly 20 miles in breadth, embracing the towns of Klausthal, Goslar, Blankenburg, and Wernigerode. The Brocken, its highest summit, is 3742 feet high. (See *Brocken.*) That part of the Harz which includes the Brocken, with the neighbouring high summits, is called the Upper Harz, and consists entirely of granite. The south-east portion is called the Lower Harz. The Harz abounds in woods and fine pastures; and is rich in minerals, including silver, iron, lead, copper, zinc, arsenic, manganese, granite, porphyry, slate, marble, and alabaster.

Has′drubal (more correctly *Asdrubal*, ‘Baal is his help’), the name of several Carthaginian leaders, particularly the brother of Hannibal, the hero of the second Punic War. On the departure of Hannibal for Italy, 218 B.C., he was left in command of the army in Spain, in which capacity he carried on a long series of military operations against the Roman troops, which were commanded by Cnæus and Publius Scipio. His brother Hannibal requiring his assistance in Italy, Hasdrubal led an army from Spain into that country (207 B.C.), but before he could join forces with his brother he was defeated on the right bank of the Metaurus by Claudius Nero and M. Livius. Nero is said to have thrown Hasdrubal's head into Hannibal's camp, by way of announcing the defeat and death of his brother.

Hash′ish (Ar. *hashish*, herbage, hay, from *hashsha*, to cut grass), an intoxicating preparation made in Eastern countries from common hemp (*Cannăbis satīva*), or rather from the Indian variety of it (*Cannăbis indica*); also a name for this plant itself or for its tender shoots. The juice of the plant has powerful narcotic properties, and is variously made use of. A resin which the plant gives out is often gathered and kneaded and formed into small balls called *churrus*, and from this a narcotic is prepared. It has the appearance of a tenacious ointment of a greenish-yellow colour, with an acrid savour and a nauseous smell. Hashish produces a kind of intoxication, accompanied with ecstasies and hallucinations. When dried and smoked as tobacco, the plant is called *bhang*; or this name is given to a drink prepared from the leaves and shoots. *Ganja* or *Gunja* is the dried shoots of the female plant with the resin on them. Hashish in several forms is employed in medicine. The English ‘assassin’ is derived from the Ar. *hashishin*, or hemp-eaters.

Haslingden, a municipal borough, England, county of Lancaster, 16 miles north of Manchester, with manufactures of cottons and woollens; coal-mines, quarries, &c. Pop. 17,485.

Hasselt, a town, Belgium, capital of Limburg, on the Demer, with manufactures of tobacco, lace, linen; distilleries, &c. Pop. 17,000.

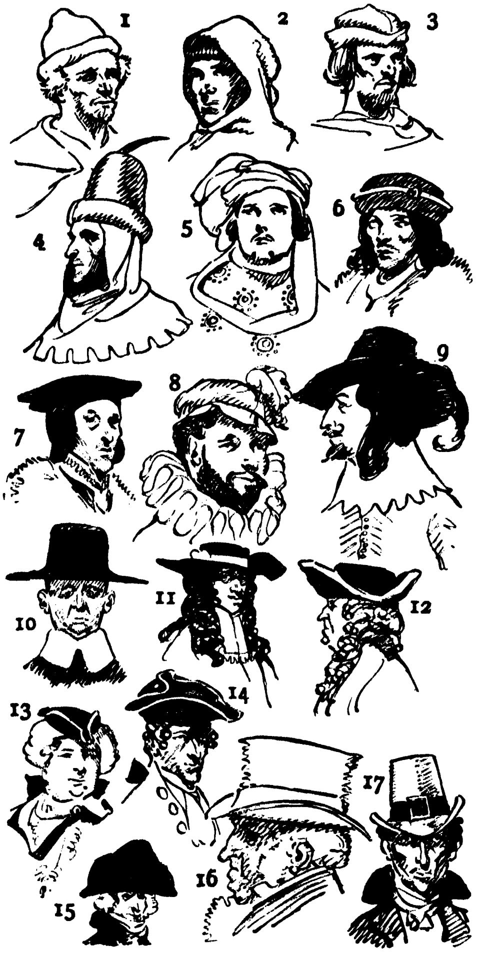
Hastings, Francis Rawdon, Marquess of, Governor-General of India, born 1754, died 1825. Having studied at Oxford, he entered (1771) the 15th Foot, and from 1776 to 1782 he served with distinction in the American War. In 1793 he became Earl of Moira, and in 1795 commanded the expedition to Quiberon. From 1813 to 1823 he was Governor-General of India, and was successful in the Nepaulese and Mahratta Wars. In his latter years he was Governor of Malta.

Hastings, Rev. James, Scottish Biblical scholar, born 1855 at Huntly, Aberdeenshire, and educated at Old Aberdeen grammar-school and the University of Aberdeen, where he graduated M.A. in 1876. He entered the ministry of the Free Church, and was ordained minister at Kinneff, Kincardineshire, in 1884. From 1901 to 1911 he was minister of St. Cyrus United Free Church, in the same county. He has edited *The Expository Times* since its foundation by himself in 1889, but he is better known as editor of a *Dictionary of the Bible* (4 vols. and supplementary vol., 1898–1904), a *Dictionary of Christ and the Gospels* (2 vols., 1906–7), a *Dictionary of the Bible* (in one vol., 1908), and the *Encyclopædia of Religion and Ethics.* He died Oct. 15th, 1922.

Hastings, Warren, English statesman and first Governor-General of India, was born at Daylesford, in Worcestershire, 1732, and died there 1818. A grandson of the rector of Daylesford, he was educated at Westminster School, and in 1750 he set out for Bengal in the capacity of a writer in the service of the East India Company. When stationed at Cossimbazar, he was taken prisoner by Surajah Dowlah on the capture of the place (1756). Having made his escape, he served as a volunteer under Clive in 1757. He was representative of the Company at Moorshedabad from 1758 to 1761. In the latter year he removed to Calcutta, having obtained a seat in the Bengal Council, but returned to England in 1764. As he lost the bulk of his means by unfortunate Indian investments, he again entered the Company's service, and sailed for India in 1769. In consequence of the misgovernment of the Nawab of Bengal the Company had deprived him of all real power, and now wished to have the country more directly under their control. Warren Hastings was its chief instrument in this undertaking, and in 1772 became president of the Supreme Council of Calcutta. Mohammed Reza Khan, the administrator of the revenues of Bengal, was now accused, by an unprincipled character named Nuncomar, of corruption and abuses of power. In this prosecution Hastings acted as the tool of the Company. Mohammed and Shitab Roy, Dewan of Behar (who had been similarly accused), were afterwards honourably acquitted, but meantime the reorganization desired by the Company had been carried out. In 1773 the Company's powers were considerably modified by an Act of Parliament, and Hastings now received the title of Governor-General of India. As the majority of the Council disapproved of Hastings's past policy, Nuncomar, his old ally, took advantage of the circumstance to accuse him of peculation (1776). The accusations were favourably received by the Council, when Nuncomar was suddenly accused by a Calcutta merchant of forgery, was tried, and executed—a fate which he undoubtedly deserved. In 1776 the directors of the Company petitioned Government for his removal from the Council, but Hastings resigned, and a successor to him was appointed. In 1777 one of the members of the Council died, and Hastings, having thus procured a casting vote, withdrew his resignation, and returned to office. He now displayed extraordinary resource in meeting dangerous movements on the part of the Mahrattas, the Nizam of the Deccan, and Hyder Ali of Mysore, and to procure the needful money was less than scrupulous in his treatment of the rulers of Benares and Oudh. He thus gave good grounds for censure, and a motion for his recall was passed in the House of Commons. Fox's India Bill was thrown out in 1783, but next year Pitt's Bill, establishing the board of control, passed, and Hastings resigned. He left India in 1785, and was impeached by Burke in 1786, being charged with acts of injustice and oppression, with maladministration, receiving of bribes, &c. This celebrated trial, in which Burke, Fox, and Sheridan thundered against him, began in 1788, and terminated in 1795 with his acquittal, but cost him his fortune. The Company in 1796 settled on him an annuity of £4000 a year, and lent him £50,000 for eighteen years free of interest. He passed the remainder of his life in retirement at Daylesford, which he purchased.—Bibliography: Lord Macaulay, *Essay on Warren Hastings*; L. J. Trotter, *Warren Hastings*; Sir G. W. Forrest, *The Administration of Warren Hastings*; Sir A. Lyall, *Warren Hastings*; F. M. Holmes, *Four Heroes of India*; G. W. Hastings, *A Vindication of Warren Hastings*.

Hastings (hās'tingz), a parliamentary, county, and municipal borough, and market town of England, county of Sussex, one of the Cinque Ports, pleasantly situated on the sea-coast, and including the suburb of St. Leonards-on-Sea. In front of the town is an esplanade, an older and a newer pier, and large baths, while there are public gardens and pleasure-grounds, sheltering hills, and cliffs. Fishing and boat-building are carried on, but the principal support of the town is derived from the numerous visitors who frequent it during the bathing and winter seasons. There are here the ruins of an ancient castle, and of a church and conventual buildings, supposed to have been founded in the reign of Henry I. William of Normandy defeated Harold near here, 14th Oct., 1066. Hastings sent two members to Parliament from 1366 to 1885, since when it returns only one member. Pop. 66,496.

Hat (A.Sax. *hæt*), an outdoor covering for the head of various shapes and materials (as felt, silk, wool, straw), but having a *brim* as its most distinctive and general feature. Hats are of ancient origin. Among the Greeks, for instance, the *petasos* was worn, which had a brim, and was similar to the round felt now worn. The shape of the hat has varied extremely in Europe at different periods. The first modern hat, as we now know this article, was made in Paris at the beginning of the fifteenth century, but it was adopted only half a century later by the French. The *dress hat* or *silk hat* with a smooth nap outside is still an important article of attire, though felt hats are in more general wear. (See *Felt*.) The silk hat was invented at Florence about 1760. The manufacture, however, did not make much progress till 1828. Up to and even after this time beaver fur was the chief material for hats. A silk hat is composed of a skeleton, to which the silk plush is glued. The skeleton, consisting of three parts, the cylindrical part or body, the crown, and the brim, is usually made of linen, covered with gum-lac, and to the cylindrical part the crown is gummed. The cylindrical part is made by gumming together the edges of a piece of cloth shaped on a cylinder. The brim is composed of superposed layers of stiffer cloth, and made with a flat projecting surface round its inner edge, which is gummed to the skeleton. For covering the hat a sort of hood of silk plush is made, cut across in an oblique line. This cover is drawn over the skeleton on the block, and fitted exactly to it by the application of a hot iron. The heat of the iron melts the gum-lac, which on cooling cements the covering to the skeleton. The edges of the oblique cut are also coated with gum-lac. The hat is finally shaped on the block or form, and the plush damped and polished while the hat revolves on a turning-lathe. In the manufacture of straw hats the straw commonly used is that of wheat or barley. The best comes from Italy, and particularly from Tuscany, but straw hats are also largely made in England. Palm-leaf hats are imported from China and elsewhere, and are also machine-made in the United States. Felt hats are made of fur, wool, or a mixture of the two. When fur is used, it is fed from a rapidly revolving cylinder to the perforated surface of a more slowly revolving metal cone. By means of a fan, a strong current of air is drawn through the perforations, so that the fibres of fur cling closely to the cone. When the proper amount for a hat has been collected, the mass is treated with hot water and made to cohere firmly by pressure. It is then roughly shaped, dyed, and stiffened. Soft felt hats are stiffened with water paste, hard felt hats with a solution of shellac. Lastly, the hat is shaped on a block, polished with emery paper, bound and lined. Opera hats have collapsible metal frames, and are covered with silk or merino.—Cf. G. W. Rhead, *Chats on Costume*.



Hats

1, Eleventh century. 2, Twelfth. 3, Thirteenth. 4, 5, Fourteenth. 6, Fifteenth. 7, 8, Sixteenth. 9, 10, 11, Seventeenth. 12, 13, 14, 15, Eighteenth. 16, 17, Nineteenth.

Hatchment (corrupted from *achievement*, Fr. *achèvement*), in heraldry, the coat of arms of a person dead, usually placed on the front of a house, in a church, or on a hearse at funerals, by which the fact of the death and the rank of the deceased may be known; the whole being distinguished in such a manner as to indicate whether the person was man or woman, married or single.

Hat'field, or Bishop's Hatfield, a town of England, in the county of Hertford. Near it is Hatfield House, built by Sir Robert Cecil, the residence of the Marquess of Salisbury. It was under an oak tree in the park here that Elizabeth is supposed to have been seated when she was informed of her accession to the throne. The church of St. Etheldreda, dating from Norman times, was restored in 1872. Pop. 9075.

Háthras, a town of India, United Provinces, Aligarh district, formerly one of the strongest fortresses in India, now a great commercial centre. Pop. 37,854.

Hatti-sherif (Ar. *khatt*, script, and *sarif*, sublime), the Turkish name of an edict signed by the Sultan, who subscribes it usually with these words: " Let my order be executed according to its form and import ". These words are usually edged with gold, or otherwise ornamented. An order given in this way is irrevocable. The *hatti humayun*, or the firman of the 18th Feb., 1856, is important, as it formally recognized the principle of religious liberty in Turkey.

Hatto, the name of two Archbishops of Mainz, of which the second, who died in A.D. 969 or 970, is the best known. He was Abbot of Fulda until 968, when he was appointed Archbishop of Mainz. Of his subsequent life very opposite accounts exist; some represent him as an upright prelate and reformer of abuses; others in the blackest colours. The legend of his being devoured by rats (the fable of the 'Mäusethurm'), popularized by Southey, is well known.—Cf. S. Baring-Gould, *Curious Myths of the Middle Ages.*

Hatton, Sir Christopher, Lord Chancellor of England, a favourite of Queen Elizabeth, born about 1540, died 1591. He was introduced at court in 1564. He entered Parliament in 1571, became captain of the queen's guard in 1572, Vice-Chamberlain and a Privy Councillor in 1577, and Lord Chancellor in 1587. He was one of the Commissioners for the trial of Mary, Queen of Scots, in 1586.

Hauff (houf), Wilhelm, German novelist and writer of humorous and fantastic stories, born 1802, died 1827. His first publication was his *Almanack of Tales for the Year 1826*, which was followed by similar collections for the next two years, the whole forming a collection that has been highly popular. Extracts from the *Memoirs of Satan* appeared in 1827, but remained uncompleted. *Lichtenstein*, a novel written under the inspiration of Sir Walter Scott, appeared in 1826, and is one of the best German novels of its class. In 1827 was issued *The Man in the Moon*, and the same year *Fantasies in the Wine Cellar of Bremen Council*, a piece of excellent humour. Among the best of his works are two novelettes, *The Picture of the Emperor* and *The Beggar-woman of the Pont-des-Arts.*

Hauptmann, Gerhart, German dramatist, born at Salzbrunn, 15th Nov., 1862, the son of an hotel-keeper and grandson of a weaver. After studying art at Breslau and Rome, he returned to Germany in 1885, where he married a lady of wealth and settled to literary work, especially play-writing. His first dramas, *Vor Sonnenaufgang* (1889), *Das Friedensfest* (1890), *Einsame Menschen* (1891), and *Die Weber* (1892), breathe a spirit of revolt against social conditions and artistic ideals. The author's naturalism is distinctly pessimistic, and one feels the influence of Zola and Tolstoy. His plays produced after 1892 are of a more varied nature, more humorous, and less pessimistic. Among these are: *Kollege Crampton* (1892), *Der Biberpelz* (1893), *Hannele's Himmelfahrt* (1894), *Fuhrmann Henschel* (1898), and *Griselda* (1909). Hauptmann was made an honorary D.C.L. of Oxford University in 1905, and received the Nobel prize of literature in 1912.—BIBLIOGRAPHY: E. E. Hale, *Dramatists of To-Day*; K. Holl, *Gerhart Hauptmann: his Life and his Work.*

Hauran, a district in Palestine, east of the Jordan and south of Damascus. It contains the ruins of many ancient towns, with numerous Greek inscriptions, both Christian and pagan. In the Roman period it was one of the four provinces of Bashan. It is fertile but thinly inhabited. A railway reaches it from Damascus.

Haustella'ta, a term applied to insects with sucking mouth-parts, such as butterflies and two-winged flies, as contrasted with the Mandibulata, which possess biting mouth-parts, e.g. beetles. See *Entomology*.

Hausto'rium, in botany, a special organ for the absorption of food, such as the suckers of dodder and other parasites. Most parasitic Fungi (e.g. rusts and mildews) live in the intercellular spaces of their hosts, whence they tap the living cells by means of haustoria. In monocotyledonous plants the tip of the cotyledon remains inside the seed at germination, and digests and absorbs the food stored in the endosperm; this is well seen in the date-palm, where the haustorial part of the cotyledon grows enormously during germination, gradually eating its way through the entire stone.

Haüy (à-ü-ē), René Just, a French mineralogist, born 1743, died 1822. He studied theology, became an abbé, and during twenty-one years occupied the place of a professor, at first in the College of Navarre, and afterwards in that of the Cardinal Le Moine. He studied botany, and subsequently mineralogy, and introduced a once celebrated system of crystallography. On the outbreak of the Revolution Haüy was imprisoned for refusing to subscribe to the new Constitution, but his life was saved by the exertions of Geoffroi de St. Hilaire. In 1793 he was appointed a member of the Commission of Measures and Weights, in 1794 conservator of the Cabinet des Mines, and in 1795 teacher of physics in the École Normale. In 1802 Napoleon made him professor of mineralogy in the Musée d'Histoire Naturelle, and also shortly after in the Faculté des Sciences. Haüy was remarkable for the extreme modesty of his disposition. His principal writings are his *Essai sur la théorie et la structure des cristaux* (1784), his *Traité de minéralogie* (1802), his *Traité élémentaire de physique* (1803), and his *Traité de cristallographie* (1817), &c.—His brother Valentin, born 1745, died 1822, started the first institution for the instruction of the blind.

Havan'a (Sp. *La Habana*, 'the haven'), an important maritime city, capital of Cuba, on the north-west side of the island, with an extensive and excellent natural harbour. The town in the older parts has narrow, badly-paved streets, but there are also wide and handsome promenades and avenues. The houses, which are low and with flat roofs, resemble those of Southern

Spain. Havana is the see of a bishop, and the seat of the Governor. The cathedral long contained the ashes of Columbus, which were brought hither from San Domingo in 1796. Among the other buildings are the Governor's house, the admiralty, the university, the exchange, and the opera-house. The staple manufacture is that of its celebrated cigars. The other manufactures, consisting chiefly of chocolate, straw hats, and woollen fabrics, are not of much consequence. The trade is extensive, the most important articles of export being sugar and tobacco, unmanufactured or in the form of cigars and cigarettes; other exports are molasses, coffee, wax, honey, and rum. The United States have the principal share of the trade, and Spain and England rank next. Several railways start from Havana. The town was founded in 1511, but was only fairly begun in 1519. For a long time Spain derived the chief part of her fleet from the building-yards of Havana, which still have some shipbuilding. Pop. 363,506.

Hav′el, a navigable river of Germany, with extensive canal connections, rises in Mecklenberg-Schwerin, enters Prussia, flows past Spandau, receives the Spree, and joins the Elbe after a course of 160 miles.

Havelberg, a town in Prussia, province of Brandenburg, on the Havel, engaged in brewing, sugar-refining, and shipbuilding. Pop. 6170.

Havelock (hav′lok), Sir Henry, British soldier, born at Bishop-Wearmouth, near Sunderland, on 5th April, 1795, died 24th Nov., 1857. Having entered the army, he served with distinction in the Burmese War (1824–6). In 1829 he married a daughter of Marshman, the celebrated missionary, became a Baptist, and was distinguished during the remainder of his life by his earnest religious zeal. He attained his captaincy in 1838, participated in the Afghanistan War, was present at the storming of Ghazni and the capture of Kabul, and in Sale's march to Jelalabad, and assisted in the defence of that city, and in the defeat of Mohammed Akbar, 1843. He was made a Companion of the Bath, and brevet-major, took part in the Mahratta War, and distinguished himself in the Sikh War of 1845, being present at Mudki, Ferozeshah, and Sobraon. In 1851 he was promoted to the adjutant-generalship of the queen's forces in India, and he commanded a division in the Persian War (1856–7). On the outbreak of the Indian Mutiny he was dispatched to Allahabad in order to support Sir H. Lawrence at Lucknow and Sir H. Wheeler at Cawnpore. On his march to Cawnpore he defeated the rebels at Fattihpur, Aong, Pandunadi, and Maharajpur. On arriving at Cawnpore he found that Nana Sahib had massacred the prisoners. Pursuing his march to Lucknow, he defeated the rebels at Bithoor, and finally, with the aid of Outram, won the battle of Alumbagh. Having captured Lucknow, Havelock and Outram were shut up there until relieved by Sir Colin Campbell, 17th Nov., 1857. A week later he died of dysentery at Dilkusha. He was raised to the rank of major-general, made a K.C.B., and (before his death was known) created a baronet.—BIBLIOGRAPHY: A. Forbes, *Havelock*; F. M. Holmes, *Four Heroes of India.*

Haverfordwest, a town of Wales, county town of Pembroke, and one of the Pembroke district of parliamentary boroughs, on the West Cleddaw River. It manufactures paper, and has a small shipping trade. Pop. 5750.

Hav′erhill, a market town of England, in the south-west corner of Suffolk, with manufactures of horsehair cloth, silk, clothing, &c. Pop. 4083.

Haverhill, a town of the United States, in Massachusetts, on the Merrimac, with extensive manufactures of boots and shoes. Pop. 53,887.

Havildar′, the highest non-commissioned rank in the infantry of the Indian army. It corresponds with the rank of sergeant in the British service, but does not give authority over British soldiers. In the cavalry the corresponding rank is that of duffadar. The rank is also used in the Indian police force.

Havre (ä-vr), **Le** (formerly *Le Havre-de-Grâce*), a seaport of Northern France, department of Seine-Inférieure, on the north side of the estuary of the Seine, 108 miles north-west of Paris, built of brick or stone in straight, wide streets. The public buildings possess little interest. The town has a number of industrial establishments, sugar-refineries, breweries, and shipbuilding-yards. But the chief dependence of Havre is on its commerce, which is the greatest of any French port next to Marseilles. It has a large trade with England and Germany, and especially with America, importing great quantities of cotton and other produce; and exporting numerous articles of French manufacture. In 1918, 2382 vessels with a tonnage of 2,818,000 entered the port, and 736 vessels with a tonnage of 585,000 cleared it. The importance of Havre dates from the early part of the sixteenth century. Havre was a base of the British Expeditionary Force during the European War, and the seat of the Belgian Government from Oct., 1914, to Nov., 1918. Pop. (1911), 136,159.

Hawaii (hȧ-wī′ē). See *Sandwich Islands.*

Hawarden (ha̤r′den; Welsh name *Penarlag*), a town in Flintshire, Wales, lying in a coal district, and having valuable clay beds in the vicinity. In the neighbourhood is Hawarden Castle (built in 1752), the residence for years of W. E. Gladstone. Pop. (rural district), 23,985.

Hawes, Stephen, an English poet, born about

1474, died about 1523, but the exact date of his birth and death is unknown. His principal work is *The Historie of Graunde Amour and la Bell Pucell, or The Pastime of Pleasure.*

Hawfinch (*Coccothraustes vulgăris*), one of the largest of the finches. It resembles the chaffinch in colour, but is distinguished from it by its enormous beak, larger size, and bill-hook formation of some of its wing-feathers. It feeds on all kinds of berries. It is found in some parts of Britain.

Hawfinch (*Coccothraustes vulgăris*)

Hawick (ha̤'ik), a municipal burgh of Scotland, in Roxburghshire, on the Teviot, 50 miles s.w. of Edinburgh. The staple industries of the town are the manufacture of hosiery and tweeds, but tanning, skin-dressing, oil-making, dyeing, and iron-founding, are also carried on. Until 1918 the Border or Hawick Burghs, of which Hawick was one, returned one member to Parliament. They are now merged in the county of Roxburgh. Pop. 16,353.

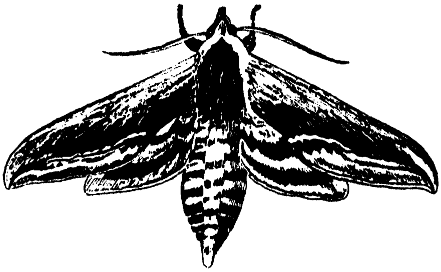
Hawk, a name often applied to all birds of prey except the eagles, vultures, and owls. In this broader sense it includes falcons, buzzards, harriers, and kites, as well as the hawks proper. These last are long-legged birds with short wings which do not reach the extremity of the tail, and have the fourth quill longest and the first short; their beaks are comparatively weak, and never notched. Of the hawks proper the chief British species are the goshawk and the sparrow-hawk (q.v.). See *Falcon.*

Hawke, Edward, Lord, a celebrated naval commander, born in 1705, died 1781. Entering the navy as a midshipman, he received the command of the *Wolf* in 1734, and in 1747 he became commander of a squadron, and defeated the French fleet at Belleisle. Hawke was in consequence made a K.B., and Vice-Admiral of the Blue. In 1759 he defeated the French at Quiberon, and in 1765 he was appointed Vice-Admiral of Britain, and was elevated to the peerage in 1776.

Hawke's Bay, a district of New Zealand, on the east coast of North Island; area, 3,050,000 acres, containing much fertile soil, well adapted for agricultural and pastoral purposes. The capital is Napier. Pop. (1920), 60,246.

Hawkins, Sir John, English sea commander, born at Plymouth 1532, died 1595. He made several voyages in his youth, and in 1562 and 1564 he went on expeditions to Africa in order to procure negroes for the West Indies. A third expedition, in 1567, was disastrous, as his fleet was defeated by the Spaniards. He became Treasurer of the Navy in 1573, and in 1588 was appointed vice-admiral in the expedition against the Armada, and received a knighthood for his services. In 1590 he and Frobisher unsuccessfully attempted to intercept the Spanish plate fleet, and in 1595 he and Drake led an unsuccessful expedition against the Spaniards in the West Indies, in the midst of which Hawkins died.—Cf. W. H. D. Adams, *English Heroes in the Reign of Elizabeth.*

Hawk-moth, one of the sphinx moths, so called from its hovering motion, which resembles that of a hawk looking for its prey. The smooth caterpillars usually possess a horn-like projection on the eleventh segment, are strikingly coloured, and often assume remarkable attitudes. Well-known species are: death's-head hawk-moth (*Acherontia atrŏpos*), privet hawk-moth (*Sphinx ligustri*), and humming-bird hawk-moth (*Macroglossa stellatarum*).



Privet Hawk-moth (*Sphinx ligustri*)

Hawkweed (Hieracium), a genus of composite plants, sub-ord. Cichoraceæ, consisting of numerous species with yellow flowers, common weeds in Britain and other parts of Europe. The pappus is brown and brittle, and in many species the leaves, involucres, and stems are hairy. *H. Pilosella* is the best known in Britain. Its brilliant yellow flower often appears in heaths and pastures.

Hawkwood, Sir John, an English soldier of fortune, date of birth unknown, died 1394. His name is spelt by contemporaries as Aguto, Aucud, and Haccoude. On the invasion of France by Edward III Hawkwood was knighted on account of his courage and ability. He is said to have fought at Crécy and Poitiers. In 1360 he occupied a prominent place in the marauding companies which harassed France. He next took regular service under the Pisan Republic for twenty-three years, but in 1387 he entered that of the Florentines. He founded the English hospital at Rome, and died at Florence.

Haworth, a parish and town (urban district) in the West Riding of Yorkshire, 8 miles northwest of Bradford. The Rev. Patrick Brontë, father of the famous sisters Brontë, was long incumbent, and the graves of Charlotte and Emily are there. Pop. 6605.

Hawthorn, or **Whitethorn** (*Cratægus Oxyacantha*), a small spiny European tree, belonging to the sub-ord. Pomeæ of the ord. Rosaceæ, rising sometimes to the height of 20 to 25 feet. The leaves are alternate, obovate, 3- to 5-lobed; the flowers are white, sometimes with a reddish tinge, disposed in corymbs, and possess an agreeable perfume; the fruit is a drupe of a red colour, and is edible. The species are about fifty in number, all shrubs or small trees. A number of them belong to the United States. When young, the hawthorn springs up rapidly, and, if pruned, grows into a thick hedge. When it arrives at the height of a tree, however, it makes wood very slowly. The timber is hard and durable, and fit for many purposes of utility. The double-flower kind is one of the most ornamental for shrubberies. Hawthorn blossom is often called *May*, from the time of its flowering in England.

Hawthorne, Nathaniel, American author, born at Salem, Massachusetts, 1804, died 1864. He studied at Bowdoin College, where he took his degree in 1825 along with the poet Longfellow. For a number of years after this he led a retired and studious life in Salem, writing tales, some of which appeared in newspapers and magazines. In 1837 appeared his *Twice-told Tales*, a collection of stories which he had contributed to various American periodicals. In 1838 he was appointed a weigher in the Boston custom-house, a post which he held for a few years. In 1846 he published his *Mosses from an Old Manse*, in 1850 *The Scarlet Letter*, in 1851 *The House of the Seven Gables*, and in 1852 *The Life of Franklin Pierce*, and *The Blithedale Romance*. In 1853 he became American Consul at Liverpool, a post which he held until 1857. He died at Plymouth, New Hampshire. Other works are his *Transformation* (1860), and *Our Old Home* (1863). — BIBLIOGRAPHY: Henry James, *Hawthorne* (English Men of Letters Series); Moncure D. Conway, *Life of Nathaniel Hawthorne* (Great Writers Series).

Hay (A.Sax. *hīeg*, Goth. *hawi*), the stems and leaves of grasses and other plants cut for fodder, dried in the sun, and stored usually in stacks. The time most suitable for mowing grass intended for hay is that in which the saccharine matter is most abundant in the plants, viz. when the grass is in full flower. For the operation of mowing, dry weather, and, if possible, that in which sunshine prevails, is chosen. The making of the grass into hay generally takes three or four days to get it ready for stacking. This period is principally occupied in alternately *tedding* (i.e. shaking out the grass loosely) and gathering it up into cocks or small heaps, previous to stacking. Care must be taken to avoid haymaking either under a scorching sun or during the prevalence of rain, and the cocks should never be opened in the morning until the disappearance of the dew. In stacking, the great object is to preserve the freshness of the herbage, and to induce a slight degree of fermentation. If the weather has been wet, a few layers of straw may be inserted at intervals. Salting is also recommended.

Hayashi, Count Tadasu, Japanese diplomatist, born at Sakura 22nd Jan., 1850, died 10th July, 1913. Educated in England, he was employed in the Japanese Foreign Office from 1891 to 1895, when he was sent as Minister to China till 1897, and to Russia till 1899. He represented Japan at the Hague Peace Conference in 1900, and in the same year became Ambassador in London. During his tenure of office treaties were concluded between Japan and Great Britain (in 1902 and 1905). He returned to Japan in 1905, and was Foreign Minister from 1906 to 1908, and Minister of Commerce from 1911 to 1913.—His namesake, *Baron Gonsuke Hayashi*, born in 1860, became Japanese Ambassador in London in 1920.

Haydn (hī'dn), Franz Joseph, a celebrated Austrian musical composer, born at Rohrau, near Vienna, 1732, died 1809. At the age of six he was sent to school at Hainburg, where he learned, among other things, singing and playing by rote. On account of the excellence of his voice he was appointed a choir-boy at St. Stephen's Church, Vienna. At the age of sixteen his voice began to break, and he lost his situation as a chorister. Having made the acquaintance of Metastasio, Porpora, and Gluck, Haydn gradually attracted public attention, was appointed organist to two churches, and obtained many pupils. From 1761 to 1790 he was musical director to Prince Esterhazy, and composed during this period a great number of works, including some 120 symphonies for the orchestra, 12 operas, &c. In 1791 and 1794 he visited

England, staying there nearly three years altogether, and writing his opera *Orpheus and Eurydice*. In 1798 he published his oratorio of *The Creation*, and in 1800 that of *The Seasons*. His old age was exempt from pecuniary troubles, and he was surrounded by appreciative friends. His last public appearance was at a performance of his *Creation* in 1808. Haydn's principal merit consists in his opening up a new development of instrumental composition, of which his 125 orchestral symphonies furnish abundant proof. He may be said to have been the originator of the symphony and of the stringed quartette.—BIBLIOGRAPHY: C. F. Pohl, *Joseph Haydn*; P. D. Townsend, *Joseph Haydn*; J. C. Hadden, *Joseph Haydn* (Great Musicians Series); article in Grove's *Dictionary of Music and Musicians*.

Hay′dock, a town (urban district) of south-west Lancashire, 3 miles north-east of St. Helens, with large collieries. Pop. 10,333.

Hay′don, Benjamin Robert, an English historical painter, born in 1786, died by his own hand in 1846. In 1804 he became a student of the Royal Academy, and in 1807 exhibited his first work, *Joseph and Mary Resting* (in Egypt), and his *Dentatus* in 1809. His *Judgment of Solomon* appeared in 1814. In 1815 he established a school in opposition to the Academy, an undertaking which ended in pecuniary failure in 1823. He was several times in prison for debt, was always complaining of injustice and neglect, and finally became deranged when he failed to be employed in decorating the new Houses of Parliament. He was the chief English historical painter of his time, and a man of great intellectual ability generally, but self-willed, perverse, and devoid of tact. Of his pictures the principal are: *Christ's Entry into Jerusalem*, *The Raising of Lazarus*, *The Mock Election*, *Chairing the Member*, *Pharaoh Dismissing Moses*, *The Burning of Rome*, *The Banishment of Aristides*, and *Quintus Curtius Leaping into the Gulf*. He left an interesting autobiography.—Cf. F. W. Haydon (editor), *Haydon's Correspondence and Table-Talk*.

Hay-fever, Hay-asthma, or **Summer Catarrh** is a disease affecting the upper air-passages, often associated with asthmatic attacks, and due to the action of the pollen of certain grasses and plants. It is more common in America and Great Britain than on the Continent. Women are more subject to it than men, and there is a definite hereditary disposition. City dwellers are chiefly affected, and of those the educated and highly nervous are most susceptible. The symptoms are those of a severe coryza, but there may be more headache and distress. There is often severe itching of the eyes, and sneezing-bouts of from twenty to fifty sneezes are not uncommon. Treatment consists of tonics for the nervous system, change to mountain air, local treatment of the nose, and antitoxin treatment; the particular infecting pollen should be discovered and the equivalent antitoxin used.

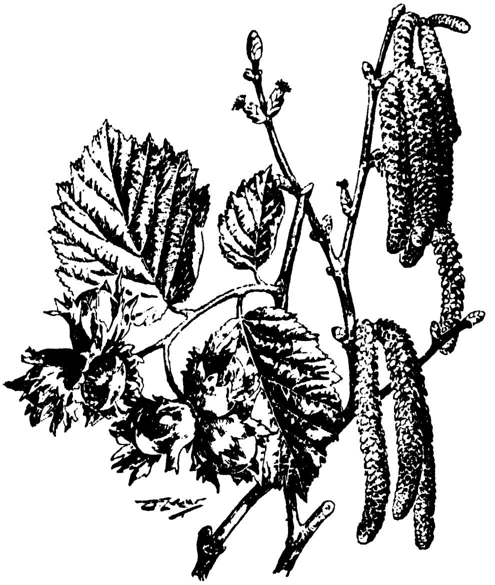
Haynau, (hī′nou), Julius Jakob, an Austrian general, born in 1786, died 1853. He took part in the battles of Austerlitz and Wagram, and was wounded in both. He also distinguished himself in the campaigns of 1813–5. In 1848 and 1849 he rendered valuable services to Austria against the Italians, took Brescia by storm, and visited it with unrelenting severity. He was afterwards carrying on the siege of Venice, when recalled by the emperor to Hungary. The storming of Raab, the advance southwards in the face of almost insurmountable difficulties, the siege of Szegedin, the battle on the Theiss, followed by the capture of Temesvar, were all effected by Haynau. He incurred extreme odium, however, on account of his severities and arbitrary measures, and in 1850 he was deprived of his powers, and retired into private life. He had an evil reputation for brutality, and had ordered women to be flogged on various occasions. When visiting London in 1850, he was flogged himself by some of the draymen of Barclay & Perkins's brewery.

Haz′ard (O.Fr. *hazard*; Sp. *azar*, unlucky throw; Ar. *al*, and *zār*, dice), a game at dice played for money. The player is called the *caster*, and his opponent, who bets with him, is called the *setter*. The former calls a *main*, i.e. any number from 5 to 9 inclusive. He then throws with two dice, and wins if he 'nicks'. 5 is a nick to 5; 6 and 12 are nicks to 6; 7 and 11 to 7, &c. The caster loses or 'throws out' if he throws aces, or deuce ace (called *crabs*). Hazard is a game involving nice calculations.

Hazaribagh (h*a*-zär-i-bäg′), chief town of the district of the same name, in Chota Nagpur, Bengal. Pop. 16,700. The district contains 7021 sq. miles. Pop. 1,164,321.

Hazebrouck (äz′brųk), a town of France, department of Nord, having a fine church with an open spire 240 feet high. It has linen manufactures, breweries, tanneries, dyeworks, &c. During the European War Hazebrouck was shelled by the German long-range gun in 1917, and in April, 1918, it was seriously threatened by the German advance, but never captured. Pop. 12,566.

Hazel (Cory̆lus), a genus of shrubs or small trees of the ord. Corylaceæ or Cupuliferæ. It belongs to Europe, North Africa, Asia, and North America. The leaves are roundish-cordate, alternate, and shortly petiolate. The European hazel (*C. Avellāna*) produces the nuts called filberts, and grows best in a tolerably dry soil. It bears male and female flowers, the former composing cylindrical catkins. The hazel-nut oil is little inferior in flavour to that of almonds. Hazel branches form excellent walking-sticks, fishing-rods, &c., and the wood produces good charcoal, often employed by painters. The American hazel (*C. americāna*) very much resembles the European. The roots are used by cabinet-makers for veneering; and in Italy the chips are sometimes put into turbid wine for the purpose of fining it.—The *witch* (or *wych*) *hazel, Hamamēlis virginica*, is a shrub or small tree of a different natural order, the Hamamelidaceæ. It is a native of the United States, and healing properties have long been ascribed to it both by the Indians and the whites. A liquid prepared from it is said to be useful as an application to wounds, stanching the bleeding and promoting healing, being applied also to bruises, sprains, bleeding piles, in internal bleeding, &c. There are several officinal preparations of the witch-hazel, especially a fluid extract and a tincture.



Hazel (*Cory̆lus Avellāna*)

Showing flowers and fruit.

Hazel-grouse (*Bonăsa sylvestris*), a species of grouse inhabiting elevated forests in the continent of Europe and great part of Asia. It feeds on berries, buds, insects, and worms; and is very good eating.

Hazel Grove, with Bramhall, an urban district of England, Cheshire, 2 miles S.S.E. of Stockport, with similar industries. Pop. 10,125.

Hazlitt, William, British essayist and critic, was born 10th April, 1778, and died 18th Sept., 1830. Hazlitt was educated at a school at Wem, in Shropshire, where his father was living, and in 1793 went to Hackney Theological College, with the intention of becoming a Unitarian minister. He abandoned this idea, and in 1802 decided to become a portrait-painter. He was not successful in this career. He became friendly with Lamb and Coleridge, however, and they increased his natural inclination towards literature as a profession. He married a Miss Stoddart in 1808; his domestic life was extremely unhappy, and he finally dissolved his marriage in 1822. After indulging in an infatuation for one Sarah Walker, he married a rich widow, and parted from her a year afterwards. Towards the end of his life he became involved in money difficulties owing to the failure of his publishers. He was bitterly attacked by his political opponents, foremost amongst whom was the redoubtable Gifford. Both his attempts at marriage were failures. All these misfortunes soured his temper and shortened his life, and he died in his fifty-third year. Hazlitt's chief works are: *An Essay on the Principles of Human Action* (1805), *A Reply to Malthus* (1806), *View of the English Stage* (1818), *Lectures on the English Comic Writers* (1819), *Characters of Shakespeare's Plays* (1817), *The Spirit of the Age* (1825), and the *Life of Napoleon Buonaparte* (1828–30).

Hazlitt was a great essayist, and possessed a beautiful and lucid style. As a critic of Shakespeare he stands extremely high. He had not Coleridge's flashes of inspiration, but he is far more reliable than Coleridge. He is nearly always sound and sensible. Some of his criticisms, which seem commonplace and orthodox to-day, were daring and original when they were first uttered. He was one of the first to emphasize what Ben Jonson had said in the poem prefixed to the First Folio:

> Yet must I not give Nature all; thy Art,
> My gentle Shakespeare, must enjoy a part.

His lectures on the English Comic Writers are less good; in many cases he seems to have got up his subject for the occasion and not to have meditated upon it sufficiently. *The Spirit of the Age* is one of Hazlitt's best books. It is written with great animation, and is in a beautiful style. In his *Letter to William Gifford* Hazlitt gave that malignant and ungentlemanly critic a lesson and a knock-down blow. Hazlitt's *Life of Napoleon* was a very large piece of work intended to be a counterblast to the biography by Scott. It was not a success. Hazlitt was an enthusiastic Liberal all his life, or rather he considered himself to be one. Actually he retained unchanged all the opinions he had formed as a young man, and did not move with the times. All those who did progress he considered as dishonest and traitorous. As he was also of a very sensitive disposition, it is not to be wondered at that he quarrelled with many of his friends. In his literary tastes Hazlitt was a confirmed Tory. He liked the old writers—Shakespeare, Milton, and Fielding were among his favourites—and he only admitted Scott grudgingly to a place in his affections. He read little after he was thirty, and was always unwilling to break new ground. In his younger days he was a keen fives player and an enthusiastic supporter of the ring; he was also an ardent theatre-goer. In spite of his many misfortunes, and their warping effect on his nature, his last words were: "Well, I've had a happy life".—BIBLIOGRAPHY: A. Birrell, *William Hazlitt* (English Men of Letters Series); P. G. Patmore, *My Friends and Acquaintances*; Sir L. Stephen, *Hours in a Library*; H. Crabb Robinson, *Diary*.

Head, the term applied to the anterior part of the body of an animal when differentiated from the rest of the body. A gradual increase of complexity in the structure of the head is observable as we ascend from the lowest to the highest forms of life. In the Protozoa, Infusoria, and Cœlenterates nothing that can be regarded as a head is found, and it is not till we ascend to the worms proper, the articulated animals (crustaceans, myriapods, spiders, and insects), the land and freshwater gasteropods (snails and whelks), and the cuttle-fishes, that a head proper is found. The cuttle-fishes have a remarkable cartilaginous box, which, like a skull, protects their anterior nervous ganglia and gives support to the muscles. The head of the vertebrated animals presents a regular series of increasing complexity, from the lancelet upwards, and as the anterior nervous mass enlarges, and its ganglia increase in complexity, so do the anterior vertebræ change their character; as the brain becomes specialized, so does the brain-case or skull, attaining its highest development in man. In man, and in the higher vertebrates, the head consists of an upper chamber, lodging the brain, with special compartments for the organs of smell, vision, and hearing, and a lower, lodging the first portion of the alimentary canal. In proportion as the vertebrates become developed, the brain increases in size, and its position advances anteriorly, until, in man, it comes to overhang the face. The head is the seat of intelligence and of consciousness, as it contains the brain and the organs of sense, touch being the only sense not limited to it. See *Skull*.

Head, Sir Francis Bond, English colonial Governor and miscellaneous writer, born 1793, died 1875. He was present at the battle of Waterloo, being in the Royal Engineers; in 1825 he undertook the working of gold- and silver-mines in Rio de la Plata; in 1835 he became Governor of Upper Canada; and in 1838 he suppressed the Canadian insurrection, and was made a baronet. He was the author of *Bubbles from the Brunnen of Nassau*, *Rough Notes of Rapid Journeys across the Pampas*, *A Faggot of French Sticks*, and *The Horse and his Rider*.

Headache is a symptom of a great number of diseases, and it may be due to any of a very wide range of causes, such as the onset of most fevers and constitutional diseases, local injuries to the head, disease of the bones of the skull, tumours and abscesses of the brain. One of the commonest causes of severe and persistent headaches is eye-strain due to some uncorrected error of refraction in the eyes. Another remarkable type of headache is migraine, in which the trouble is confined to one side of the head, and may be associated with dizziness and visual disturbances. But perhaps the commonest cause of all is disturbance of the digestive organs and especially constipation. Headache is thus a symptom of an almost unlimited series of ailments, and its rational treatment depends upon the discovery of the cause.

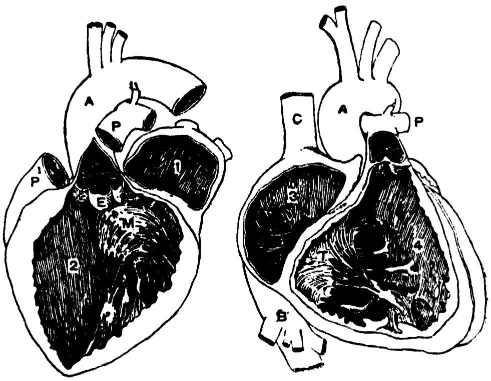
Health Acts, Public, Acts passed in order to secure the good sanitary condition of any country or district. The first British Public Health Act was passed in 1848, and was followed by others, a comprehensive general Act being the Public Health Act (1875), which has been amended and extended since. The Acts contain provisions respecting sewers, water-supply, unsound food, contagious diseases, &c. By the Act of 1848, the Board of Health was established, which existed until 1858, when its work was transferred to the Home Office. In 1871 the duties were taken over by the Local Government Board, which remained the principal authority for all matters concerning health until 1919. In this year an Act was passed, establishing the Ministry of Health for England and Wales, and the Board of Health for Scotland. These departments have taken over all the work and duties which were hitherto performed by the Local Government Board and the National Health Insurance Commission.

Heanor (hē′nor), a town (urban district) of England, Derbyshire, 3 miles north-west of Ilkeston, with ironworks, hosiery manufactures, and collieries. The mansion, Heanor Hall, is now the technical college. Pop. 21,438.

Hearne (hėrn), Thomas, an English antiquary, born 1678, died 1735. Hearne studied at Oxford, and was in 1701 appointed assistant-keeper of the Bodleian Library, and he held the post of second librarian from 1712 to 1715, but had to resign as his Jacobite principles precluded him from taking the oaths to the Government.

Among his works may be mentioned: *Ductor Historicus*, *Reliquiæ Bodleianæ*, *History and Antiquities of Glastonbury*, editions of Leland, of Spelman's *Life of Alfred*, and of Fordun's *Scotichronicon*.

Heart, a hollow muscular organ, the function of which is to maintain the circulation of the blood, the organs of circulation being the heart, the arteries, the veins, and the capillary vessels. The heart in men, quadrupeds, birds, and some reptiles is composed of four cavities, two *auricles* and two *ventricles*. It is enveloped in a membrane called the *pericardium*, and is situated near the centre of the cavity of the chest, between the lungs. With each beat the apex of the heart strikes against the wall of the chest in the space between the fifth and sixth ribs, a little below and to the right of the left nipple. The right auricle is the chamber that receives the blood returned from the body by the *vena cava superior* (from the head, arms, and chest), and the *vena cava inferior* (from the legs and abdomen), and from the substance of the heart itself by the *coronary vein* (or *sinus*). The blood is then passed into the right ventricle. The communication between this auricle and ventricle is closed by a valve when the ventricle contracts. The right ventricle communicates with the pulmonary artery which transmits the blood to the two lungs to be oxygenated and to get rid of its superfluous carbonic acid gas. The opening into the artery is guarded by a valve formed of three flaps. When these are brought together they interrupt the communication between the ventricle and the artery. The blood is brought from the lungs by the pulmonary veins and poured into the left auricle. The left auricle communicates through a valved opening with the left ventricle. The left ventricle distributes the oxygenated blood to the body by means of the aorta, also provided with a valve similar to that of the pulmonary artery. The auricles and ventricle of one side are separated from those of the other by a complete muscular partition, the *septum cordis*. The valves at the openings of the arteries are called *semilunar*, that at the orifice of the right auricle *tricuspid*, that at the orifice of the left auricle *mitral*, and that at the orifice of the vena cava inferior the *Eustachian* valve. The heart is formed of a firm thick muscular tissue, composed of interlacing fibres. The aorta gives off branches that carry the blood from the heart to all parts of the body. These arteries terminate in the capillary vessels, a series of extremely minute tubes which pass over into the veins. The veins are the channels by which the blood is brought back from the body to the right auricle of the heart. The blood which is returned from the veins is bluish in colour from excess of carbonic acid gas and deficiency in oxygen, and is called *venous*; that which leaves the left ventricle is bright red, being oxygenated, and is called *arterial*. The venous blood parts with its excess of carbonic acid and receives new supplies of oxygen in the capillary system of the lungs, flows into the pulmonary veins, thence into the left cavities of the heart, thence it passes into the aorta, and is transmitted to all parts of the body, returning to the veins by the capillary system. It is now become venous, passes through the veins from the extremities towards the heart, receiving the chyle and the lymph, and is emptied into the right cavities of that organ, which returns it through the pulmonary artery to the capillary vessels of the lungs, where it is subjected to the influence of the air, resumes the qualities of red or arterial blood, and is ready for a new course.



Sections of Human Heart

1, Left auricle with the two right pulmonary veins. 2, Left ventricle. 3, Right auricle. 4, Right ventricle. A, Aorta. B, Inferior vena cava. C, Superior vena cava. P, Pulmonary artery (semilunar valve at P^1). E, Semilunar valve at commencement of aorta. M, Mitral valve. T, Tricuspid valve.

The mechanism of the circulation is as follows: The blood contained in the two venæ cavæ is poured into the right auricle, which contracts, and thus forces the fluid to escape; but the venæ cavæ oppose to its backward passage the column of blood which they contain, and it must therefore pass into the right ventricle. The ventricle then contracts, and the tricupsid valve closing the passage through which the liquid entered, it is forced into the pulmonary artery, along which it must flow (return to the ventricle being prevented by the semi-lunar valve) into the capillary system of the lungs, whence it passes into the pulmonary veins, which pour it into the left auricle by four orifices. The contraction of the auricle impels it into the left ventricle, by which it is driven forward into the aorta (the mitral valve preventing its return into the auricle), and thence into the general circulation. The two auricles contract and relax simultaneously with each other, as do also the two ventricles. The relaxation is called *diastole*; the contraction *systole*. The quantity of blood projected at each systole is generally estimated at 6 ounces. The causes of the alternate contraction and relaxation are entirely involuntary; but events happening elsewhere in the body can influence the heart's action either by restraining or by quickening its action. This is effected partly by the vagus nerves and the sympathetic system. The systole of the ventricles is the cause of the motion of the blood in the arteries, which dilate with each wave driven into them.

The heart may be the seat of various and generally dangerous diseases. One of these is *pericarditis* or inflammation of the pericardium, the double lining membrane or bag enveloping the heart. The cause of this disease may be some direct infection, exposure to cold, or an injury, or it may be complicated with other diseases. Inflammation of the inner lining is termed *endocarditis*. *Valvular* disease is a common after-result of such a disease, which is often caused by rheumatic fever, the valves becoming thickened, contracted, rigid, or otherwise affected, so that they cannot properly perform their duty. The mitral valve, for instance, may become too narrow and contracted, and the result is that all the blood does not pass into the aorta. In other cases of valvular disease, the same result follows, viz. imperfect depletion of the ventricles and auricles, the return of blood being termed *regurgitation*. The heart consequently becomes overgrown or hypertrophied as the result of the extra work thrown upon it to compensate for this defective action. In otherwise healthy subjects this compensation may be complete and satisfactory for a time, but when it fails, *dilatation* may occur, and a variety of evil effects manifest themselves in different systems of the body. In such cases the avoidance of violent exercises and emotions is necessary. The use of *digitalis* is often successful in strengthening and soothing the heart. Certain diseases produce atrophy, in which the heart becomes feeble in action, while *fatty degeneration* occurs, when the muscular fibres are replaced by oleaginous particles. This renders the heart peculiarly liable to rupture under any strain or violent emotion, hence such should be carefully avoided by patients. Among other organic diseases of the heart are *angina pectoris*, distinguished by a sense of strangling or suffocation in the breast. A very common symptom is *palpitation*, often caused by indigestion, and the excessive use of tea and tobacco. *Syncope* or *fainting* results from the sudden cessation of the heart's action, and may be caused by excitement, emotion, or shock of some kind. Some of the above forms of heart disease can be discovered only by auscultation or percussion; others are very evident to non-professional observers.—BIBLIOGRAPHY: R. O. Moon, *Diseases of the Heart*; J. Cowan, *Diseases of the Heart*.

Heart-wood, or **Dura'men,** the older central wood in the trunks of trees, distinguished from the younger or *sap-wood* by its darker colour and harder consistency. It is quite dead, and serves only to give support to the stem. Joiners prefer it on account of its greater strength and durability. It is not formed by all trees.

Heat, a form of energy possessed by all bodies, and consisting of vibrations of the molecules, atoms, and electrons of these bodies. The most obvious physical effects produced by heat on matter are rise of temperature, change of dimensions, and change of state; heat also causes changes in the elastic and magnetic properties of bodies, thermoelectric effects, change in the electrical resistance of conductors, and change of solubility of salts in their solvents. When heat is supplied to a body, the temperature of the body will, as a rule, rise, the rise of temperature caused by a given quantity of heat depending on the thermal capacity of the body. Thus it requires about thirty times as much heat to raise the temperature of 1 lb. of water 1° as to raise the temperature of 1 lb. of mercury by the same amount. Temperature is measured by means of thermometers constructed on various principles according to the particular heat effect which is employed. The common thermometer is that of mercury in glass, which employs the expansion of mercury to measure temperatures on the Centigrade and Fahrenheit scales (see *Thermometer*; *Pyrometer*).

Heat changes the dimensions of bodies. Increase of volume is the normal effect, although the reverse is observed in water between 0° C. and 4° C., in Iceland spar crystals in a direction perpendicular to the axis, and in certain makes of invar, a steel alloy containing 36 per cent of nickel. The expansion of articles made from fused silica is extremely small. Liquids expand more than solids, and gases show the greatest amount of expansion (see *Expansion*).

When heat is continuously supplied to a solid body, rise of temperature goes on until the solid reaches its melting-point, and the body gradually changes from the solid to the liquid state. During this change the temperature becomes stationary in crystalline bodies like ice; in other bodies, such as paraffin wax, the temperature rises more slowly than at first. Heat which is absorbed, during a change of state, without causing increase of temperature, is called latent heat. If the liquid continues to receive heat, its temperature rises until the boiling-point is reached. The temperature then becomes stationary, and the liquid boils until it has all been turned into vapour, latent heat being absorbed during the change from the liquid to the gaseous state.

Calorimetry deals with the measurement of quantities of heat, the unit employed being the amount of heat required to raise unit mass of water through 1°. By the aid of this unit may be measured the quantities of heat which are gained or given out by a body during a change of temperature or a change of state. This leads to a knowledge of the relative capacities of different substances for heat. The thermal capacity of a body is measured by the amount of heat required to raise the temperature of the body 1°. If we take the thermal capacity per unit of mass, i.e. per gramme, we obtain the specific heat of the substance of which the body is composed. The specific heat, or quantity of heat, required to raise unit mass through 1°, varies for different substances, having the value 1 for water at 15° C., and, in general, smaller values for other substances. For elementary substances, the product of the specific heat and the atomic weight is nearly constant, this product being called the atomic heat of the element (see *Calorie*; *Calorimetry*).

Heat may pass from one body to another by one or other of the processes of conduction, convection, and radiation. In the process of conduction, heat is transferred from particle to particle of a body, or from one body to another in contact with it. When heat is applied to one end of a bar of iron, it is propagated through the substance of the bar, producing a rise of temperature which is first perceptible at points near the source of heat, and afterwards at remote parts of the bar. This transmission of heat is called conduction. Substances vary in regard to their powers of conducting heat; metals have the highest conductivity, and of these silver is the best conductor; next follow, in order of their conductivity, copper, gold, brass, zinc, tin, steel, iron, lead. Liquids, with the exception of mercury and other melted metals, are poor conductors of heat. Gases have the lowest conductivity of all bodies; this property is employed to prevent or diminish the loss of heat, as in the use of clothes and of the tea-cosy, and in the wrapping of straw round a pump in winter.

Convection of heat is brought about by the actual motion of the hot body. This is the usual process by means of which heat is distributed within liquids and gases. When heat is applied to the lower layers of a fluid, some of the particles become warmer than their neighbours, and expanding become relatively lighter and rise through the fluid, carrying heat with them. They are replaced by other colder particles, which in their turn become warm and rise through the fluid. Convection currents are thus set up within the fluid and a process of circulation is established. It is by means of convection that hot water is circulated in large buildings for heating and other purposes. All winds are due to convection currents in the atmosphere; convection is utilized in the ordinary methods of ventilation, and in the boiling of a kettle of water.

Radiation of heat consists in the propagation of heat from a hotter body to a colder one through an intervening medium which is not heated during the process. The heat is transmitted by the same medium that transmits light from a luminons body, and it is propagated at the same speed as light. Radiant heat and light are both vibrations of an elastic medium —the æther—and they obey the same laws of reflection, refraction, interference, and polarization. They also obey the general laws of wave motion. The rays which are given out from a luminous body are in part visible and in part invisible. Those rays which are not perceptible to the eye are partly heat rays (infra-red) and partly ultra-violet. Heat rays are further distinguished from the visible and ultra-violet rays by their greater wave-length, which ranges from about a fifty-thousandth of an inch to about a three-hundredth of an inch. The general tendency of radiation is to equalize the temperature of any system of bodies so placed as to be capable of radiating one to the other. Every body of the system is constantly sending out heat rays in all directions, and receiving the heat radiated from the other bodies. The hotter bodies emit more than they receive, whilst the colder bodies receive more than they emit, and the temperature of the system is thus gradually equalized. The rate at which heat is emitted from the surface of a body depends on the size and nature of the surface and on its temperature. Surfaces that are good radiators are also good absorbers, and surfaces which are good reflectors are bad absorbers. The best radiating surface is one which is dull black. Some substances allow rays of heat in great part to pass through them, and are said to be diathermanous. Glass allows heat rays to pass through it to a small extent, but rock salt and sylvine (chloride of potassium) transmit about 90 per cent of the incident heat rays. A solution of iodine in bisulphide of carbon and a thin plate of ebonite are opaque to light, but are capable of transmitting heat rays.

A materialistic theory of the nature of heat was held by scientists up to the beginning of the nineteenth century, the most distinguished supporters of this view being Lavoisier and Black. The experiments of Rumford and Davy demolished this theory and substituted a dynamical theory, and between 1840 and 1843 Joule conclusively established the dynamical theory of heat by measuring the amount of energy required to produce a definite heating effect. The conclusions arrived at by him were: that the quantity of heat produced by the friction of bodies, whether solid or liquid, is always proportional to the quantity of work expended; and that the quantity of heat capable of increasing the temperature of 1 lb. of water by 1° F. requires for its evolution the expenditure of mechanical energy represented by the fall of 772 lb. through 1 foot. This amount of energy or work is called the dynamical equivalent of heat, or Joule's equivalent. Determinations made by investigators by various methods in recent times show that Joule's value is too small, and the value 778 is now taken for Joule's equivalent. After Rumford and Davy, Fourier and Carnot acquired fame by their inquiries into the mathematical theory of heat. Fourier investigated the theory of conduction and radiation, whilst on the investigations of Carnot has been founded the science of thermodynamics (q.v.), which treats of the conversion of heat into mechanical energy and vice versa. The researches of Joule led to the enunciation of the principle of the conservation of energy (q.v.).—BIBLIOGRAPHY: C. H. Draper, *Heat and the Principles of Thermodynamics*; J. Clerk Maxwell, *Theory of Heat*; T. Preston, *Theory of Heat*; E. Edser, *Heat for Advanced Students*.

Heath, the common name of many plants of the nat. ord. Ericaceæ. Those that belong to the genus Erīca have their leaves simple and entire; their flowers oval, cylindrical, or even swollen at the base; the corolla is four-cleft; the stamens eight, terminated by anthers which are usually notched or two-awned at the summit; and the fruit dry, four or eight-celled. From 400 to 500 species are known, twelve or fifteen of which inhabit Europe, and have small flowers, whilst all the remainder are natives of South Africa (the vicinity of the Cape of Good Hope). Many of them bear brilliantly-coloured flowers. In Britain six species are enumerated, of which *E. tetralix* (cross-leaved heath) and *E. cinerea* (fine-leaved heath) are the most common, both with beautiful bell-shaped flowers.

Heather, or **Ling** (*Calluna vulgāris*), a low shrub, ord. Ericaceæ, which covers extensive tracts of otherwise barren moorland in Western Europe, especially in the British Islands.

Heathfield, George Augustus Eliott, Lord, British general, born in Roxburghshire in 1717, died 1790. He studied at the University of Leyden, and at the French military school at La Fère, and served for some time in the Prussian army. He entered the British army in 1735, was wounded at Dettingen in 1743, and in 1762 took part in the capture of Havana. In 1775 he became commander-in-chief of the forces in Ireland, and soon after Governor of Gibraltar. Spain and France having sided with America against Britain, Gibraltar was besieged by the two former powers, and successfully defended by Eliott from 1779 to 1783, the siege and defence being among the most memorable in history. The king sent Eliott the Order of the Bath, and shortly after he returned to England, and was created Baron Heathfield in 1787. There is a portrait of him by Reynolds in the National Gallery.

Heating.—The ancient and common method of warming houses was by the open fire built centrally on the floor. In course of time, when economical use of fuel was desired, the fire was enclosed in a brick furnace, and the hot gases of combustion were conducted in a brick flue, generally under stone flags forming the floor, which was thus warmed, and so heated the room more equally. The smoke finally escaped to the outside air, or to an upright vent. An improved form of this method, with a meandering hot-air duct and larger furnace, was the Roman hypocaust. In the east of Europe it was the custom to have large furnaces, well built and finished with porcelain or fancy tiles. In cold weather families slept on the top of the stove. In Russia a vapour bath was obtained by heating stones in a fire, and dropping them into a vessel of water, the vapour thus generated giving a pleasing and cleansing heat. Development continued, and a furnace was devised around which was an enclosed air space, the heated air from which was conducted by tubes or ducts to various parts of the house. This cheap and simple method is not yet obsolete. A serious objection to it is that the furnace is apt to fracture, allowing carbonic acid gas to escape and make the air poisonous. Occasionally, moreover, sparks of fire get into the air ducts and through some open joint, and set fire to the house. In America the fire was confined to an iron stove and the iron smoke-pipe taken up through the house to the roof—an economical but dangerous system.

In Britain heating was accomplished by open fire-places, with the smoke escaping through a slanting hole in the adjacent wall. If the wind was unfavourable, the smoke circulated and hung about the room of the Norman castle where the ladies sat at their tapestry, for ventilation as a science was not considered. In England chimneys were first built about the time of Henry VII, the idea coming from Italy. As a novelty the architects made a feature of them in their buildings, hence the tall, ornamental, twisted spirals of chimneys seen in Elizabethan and early

Jacobean architecture. In Renaissance architecture the fire-places became a prominent feature in the houses of the rich, setting a fashion which still exists for decoration about a fire-place. It is interesting to note how architecture has been affected by heating arrangements. The walls of the palaces in Rome were of fine white marble, but as smoke and vapours arose from the open joints of the floor, under which were the hot-air ducts already described, they marked the walls with streaks of black, so that architects came to adopt a scheme of dark marbles.

In the eighteenth century the fashion was introduced in this country of warming greenhouses, attached to noblemen's mansions, by means of hot air warmed by a furnace and led into a stone duct built beside the greenhouse. The escaping gases were injurious to the plants, so that the Marquis de Chabannes, a French refugee, about 1800 introduced a system of heating by large hot-water pipes, the water being heated in an iron boiler, with a supply tank open to the air connected to the pipe which joined the top of the boiler. The water circulated because the heated water, becoming expanded, was lighter than the cold water and moved upwards, cold water from the supply taking its place. One of the first buildings to be heated in this way was the Drury Lane Theatre, where the pipe rose from the boiler to an open tank, from which a pipe dropped to a large coil on each side of the stalls, and then returned to the boiler. A coil of pipes was set above the large candelabra in the gallery to assist in rarefying the air and causing an upward current through a ventilator placed in the roof. This was an immense improvement, and shows that ventilation was now being considered.

In the seventeenth century the air of the House of Commons was allowed to escape through the flat ceiling into the upper space, and thence outside as best it could. Consequently there was no ventilation, and the atmosphere soon became foul. As a remedy an ingenious Frenchman hit on the idea of building two fire-places with chimneys, one at each end of the space above the ceiling, the heat from the fires in which induced an upward current which escaped by the chimneys and made room for fresh air from outside. The atmosphere was so much improved that he received a handsome reward.

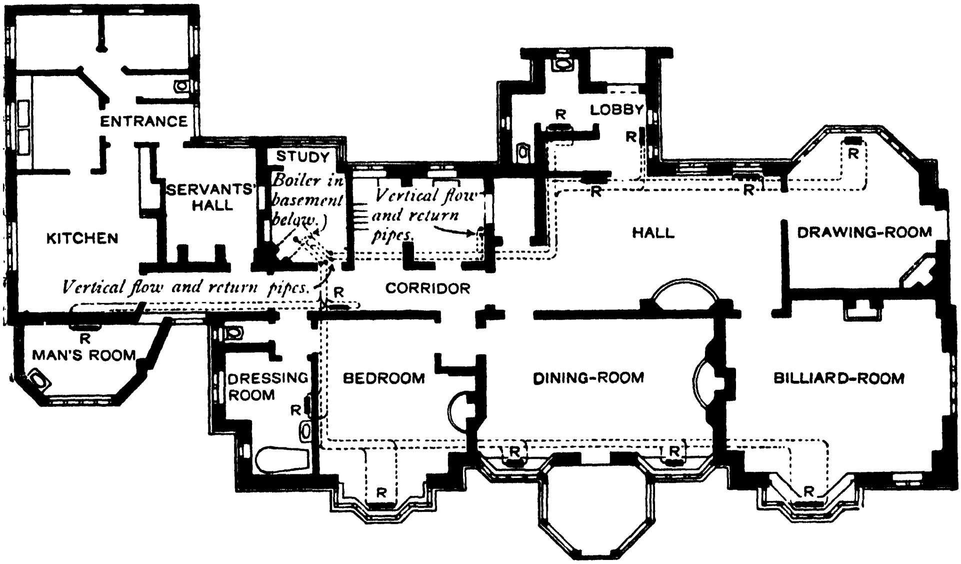
Heating by hot water, on what is known as the low-pressure system, has now superseded the hot-air method. About 1845 A. M. Perkins, of London, had a system of using strong malleable iron pipes of about one inch bore, some of which, formed into a coil, were set in a furnace and connected to pipes of the same size distributed along the rooms to be heated. A larger tube was connected to these circulating pipes. Water was pumped in and air forced out, only a small space being left in the expansion tube. A plug was then screwed into the end of this tube and heat applied. A rapid circulation of water ensued, and the pipes were raised to a high temperature. The system heated well, but as the high temperature of the pipes gave an unpleasant quality of heat, and the coils in the furnaces were apt to give way and cause accidents, it has become obsolete. One form of the system, however, is still used for heating bakers' ovens, a very high temperature being obtained.

Hot water with a maximum temperature of 200° F. gives the most suitable heat for dwellings and offices.

Steam heat is used for warming large spaces of factories and workshops. As the temperature in this system is higher, the air is more speedily warmed.

In heating buildings, pipes of suitable diameter are used, of cast iron or malleable iron, 3 inches or 4 inches being standard diameters. These sizes distribute the heat very evenly, but sometimes it is not desirable to use such large sizes, and small diameters are used, the heating surfaces being obtained by using radiators, which are cast-iron tubes formed to hold a minimum amount of water and give a maximum of radiation. The water is heated in boilers made of malleable iron, formed in a saddle shape over the fire, and encased with brick-built flues. The modern type of boiler is made of cast iron, with waterway, and in sections connected by coned iron nipples. Each section is bolted to its neighbour, and when the sections are pulled tightly together, the boiler is watertight and any section can readily be replaced. As the sections each have cross tubes, a considerable part of the furnace heat is absorbed before the gases leave at the outlet. In some types the heated gases descend to an outlet at the base of the boiler. This is economical but requires a good draught in the vent or chimney.

There are several methods in use for hot-water and for steam heating. To anyone proposing to install a heating system some words of practical advice may be useful. Do not overheat the house, and, if fire-places are disused, see that ventilation by window and vent is maintained. In heating a house place a large radiator in the hall near the front door, so that its heat may diffuse through the house generally. It is also usual to warm the sitting-room, other public rooms, and certain bedrooms, but to leave the fire-places in public rooms for social gathering round the hearth at a small fire, and to warm the cold air at the windows by the radiator. This gives equable heating and ventilation. When it is desired to heat below boiler-level or to have overhead flow and return pipes, dropping to radiators, this may be accomplished by using a small rotary pump worked by motor, and fitted on return pipe; or by the Hyflo-Gould system, which requires no pump, but has a cylinder in which the water movement of the system is accelerated by the expansion of boiling water from the boiler through a siphon and sieve, inside the cylinder, from which the flow-pipe is connected to the system. The cylinder has a vent-pipe. The system is ingenious, is not complicated, and works well.

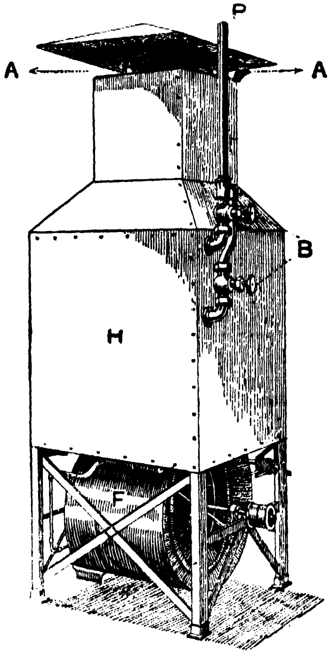


Ground-floor Plan of House, showing Low-pressure Hot-water Heating Apparatus. R, Radiator

Steam heating is used in large factories and works, in modern practice in this country. The steam is often the exhaust from the engine, and is either directed through pipes branching into the various rooms and under valve control, and finally exhausting to the air, or it may be diverted into coils of pipes with an iron casing and a centrifugal fan fitted preferably at its base; the pipes being arranged so that air forced by the fan will have the maximum heat contact with them. This air is drawn from a pure source to the fan, and a valve arrangement made so that this supply may be shut off, and the air of workshop used. The warmed air is forced from the top outlet of the casing, and circulates to a considerable radius. The waste water from the steam coil goes to a drain. Live steam up to 80 or 90 lb. per square inch may be used, and in this case the waste is returned by lifting traps to the feed tank of boiler for use. In some variations the coils form large 'batteries' of heating surface, and the air warmed by these is directed by iron ducts, fan propelled, throughout the factory. These systems are excellent, because they combine warmth and ventilation, and in summer the ducts are the means of sending cool, fresh air into the sultry workshop atmosphere. It requires proper consideration and practical experience to select the best method. In heating by steam-pipes or radiators, it is now usual to work with a low pressure, 5 lb. or even less, because an air-pump is applied, causing a partial vacuum in the pipes, so that steam at very low pressure rapidly circulates. The waste or condensed steam is pumped back to the feed-well of boiler.

When public buildings, such as poorhouses and hospitals, are in separate blocks, it is usual to have a central source of power for heat and light, consisting of steam boilers, Cornish or Lancashire type. For heating and hot-water supply, steam from the boilers is sent through copper coils fitted inside cylinders connected to these systems, and thereby warms the water which is pumped and circulated to the various buildings. The pipes are fitted in spacious ducts and insulated to conserve heat. Another practice is to take the steam supply in pipes via the ducts and to calorifiers, which are forms of the cylinders already described, and which are placed in the basement of each block and directly connected to the apparatus. The waste steam passes through steam traps, and is thence returned to the feed tank of the boilers. Some of the large housing schemes have similar systems from a central source. Each house has radiators for heating, with valve control, and also a supply of hot water. This saves fitting a separate system in each house and is economical in fuel consumption. Gas is used for cooking purposes.

In large towns central heating will help to keep the atmosphere pure, especially when the fuel in use is a proper type of coal, which has been coked. Where open fires are desired, they should be of the low-hearth type, with sides properly bevelled, so that a bright cheerful warm fire is evident. See *Heating, Electric.*—Bibliography: F. W. Dye, *Hot Water Supply,* and *Warming Buildings by Hot Water*; J. W. Hart, *The Principles of Hot Water Supply*; F. W. Raynes, *Heating Systems.*



Steam Heater. High-pressure Belt-driven Type

P, Steam inlet. B, Control valve. H, Heater casing. F, Fan and casing. A, Hot air.

By courtesy of Messrs. J. Combe & Son, Ltd., Glasgow.

Heating, Electric. When electricity flows through any conductor, a certain proportion of the electric energy is converted into heat, the amount depending upon the resistance of the wire and the square of the current passing. This action takes place in the ordinary incandescent lamp, the heating action being sufficient to raise the temperature of the lamp filament until it becomes incandescent. The proportion of energy converted into light is very small; the major portion of the energy is converted into heat, and electric heaters are manufactured employing large electric lamps of substantial proportions fitted in a frame with a reflecting back. The carbon-filament type of lamp is the most suitable for this purpose as the light efficiency is lowest. Since radiant heat can be felt directly the lamps are switched on, radiators of the luminous type are useful in all cases—such as dressing-rooms, bathrooms—where heat is desired temporarily and quickly.

Another type of electric heater employs resistance wires in sections, or elements held on thin plates or tubes of quartz or other refractory material. The wires are raised to a red-heat, and in some cases parabolic reflectors are provided, so that the heat can be directed in any desired path.

Non-luminous types of heaters employ fine wire or metal-strip elements, either bare or covered with fireproof material mounted in an ornamental case or frame. In this type the wires attain a much lower temperature than in the radiator type, and the heat is given to the cold air in the neighbourhood of the wires, raising its temperature, causing it to rise in the cold atmosphere and be replaced by cold air entering at the foot of the heater. In this way convection-currents are set up in the air and its average temperature gradually raised.

In large units the convector type of heater is provided with a fan to increase the air velocity over the heated coils. The cleanliness and ease of control are the main factors that have determined the use of electric heating, for on a question of cost it cannot compare with coal or gas.

Although electricity cannot compete with fuel for heating water in bulk, yet its convenience when dealing with small quantities has led to extensive developments in its use in such appliances as kettles, urns, and geysers, where cost of power is not the main consideration. Electric kettles are constructed with a heating element as part of the base, but an ordinary kettle of suitable make can be employed on a small heater unit, such as is used for simple cooking operations.

Electric ovens are constructed with a number of heater elements connected in sections with separate switches, so that the temperature can be regulated to suit the operations in progress. Electric irons are, perhaps, the most used of all domestic electrical appliances; in this case the heater element is fitted in a space in the base of the iron.

Heaton Norris, an urban district of England, Lancashire, forming a suburb of Stockport, with which it is connected by bridges spanning the Mersey. Pop. 11,240.

Heb′burn, a town (urban district) of England, North Durham, on the Tyne, above Jarrow, carrying on shipbuilding, and the manufacture of chemicals. Pop. 24,171.

Hebden Bridge, a town (urban district) of England, West Riding of Yorkshire, 8 miles north-west of Halifax, with cotton manufactures, dyeworks, and foundries. Pop. 6459.

Hēbē, in Greek mythology, the goddess of youth, and the cup-bearer to the gods, until replaced by Ganymede; a daughter of Zeus and Hera, who gave her as a wife to Heracles. In the arts she is represented with the cup in which she presents the nectar, under the figure of a charming young girl, her dress adorned with roses, and wearing a wreath of flowers. In Rome she was worshipped as Juventas, personifying the eternal youth of the city. She is represented in art as caressing an eagle.

Heber, Reginald, English hymn-writer and bishop, was born 21st April, 1783, died 1st April, 1826. In 1800 he entered Brasenose College, Oxford, and in 1803 wrote his Newdigate prize poem on *Palestine*. After travelling on the Continent, he became, in 1807, rector of Hodnet, and having married Amelia, daughter of the Dean of St. Asaph, was appointed prebend of the cathedral. On the death of Bishop Middleton, Heber was consecrated Bishop of Calcutta in 1823; but he had only occupied the position for about two years when he died of apoplexy at Trichinopoli in 1826. In addition to his hymns (*Brightest and best of the sons of the morning*, *From Greenland's icy mountains*, &c.), the best-known productions are *Palestine*, an edition of the works of Jeremy Taylor (with Life), and *Poems and Translations*.

Hébert (ā-bār), Jacques René, notorious during the French Revolution, was born at Alençon in 1757, executed 1794. Hébert first attracted notice as editor of the violent Jacobin organ *Le Père Duchesne*. In 1792 he became a member of the municipality of Paris which contributed to the massacres of September, and he was named Attorney-General under the Commune. In 1793 the Girondists procured his arrest, but he was released by the Convention. He was one of those who established the worship of reason, and he was always on the side of savage measures. Having denounced Danton, the latter, in conjunction with Robespierre, secured his destruction by the guillotine in 1794.

Hebrew Language and Literature, the language and literature of the Jews, Israelites, or Hebrews, especially at that period when they formed a compact nation inhabiting Canaan or Palestine. (For a sketch of the history of the people, see *Jews*.) The Hebrew language forms a branch of the Semitic family of languages, being akin to the Aramaic (Chaldee and Syriac), Arabic, Ethiopic, and Assyrian. In the antiquity of its extant literary remains Hebrew far surpasses the other Semitic idioms, and in richness and development is only inferior to the Arabic. The language is deficient in grammatical technicalities, especially in moods and tenses of the verb, in the absence of the neuter gender, &c. Its roots are triliteral (consisting of three consonants), and words are derived from them by the reduplication of the letters of the root, and by the addition of formative elements before

Form.		Name.	Pronunciation.
	Final.		
א		*Aleph*	’ (smooth breathing).
ב		*Beth*	*b* (*bh*).
ג		*Gimel*	*g* (*gh*).
ד		*Daleth*	*d* (*dh*).
ה		*He*	*h*.
ו		*Waw*	*w*, *v*.
ז		*Zayin*	*z*.
ח		*Heth*	*ḥ*.
ט		*Teth*	*ṭ* (emphatic).
י		*Yod*	*y*.
כ	ך	*Kaph*	*k* (*kh*).
ל		*Lamed*	*l*.
מ	ם	*Mem*	*m*.
נ	ן	*Nun*	*n*.
ס		*Samekh*	*s*.
ע		*‘Ayin*	‘ (rough breathing).
פ	ף	*Pe*	*p* (*ph*).
צ	ץ	*Sade*	*ṣ* (emphatic).
ק		*Qoph*	*q* (guttural *k*).
ר		*Resh*	*r*.
שׂ שׁ		*Sin, Shin*	*s*, *sh*.
ת		*Taw*	*t* (*th*).

Form, Name, and Pronunciation of the Letters of the Hebrew Alphabet and after the roots. The alphabet is composed of twenty-two consonants, the vowels being expressed by marks above or below these letters. The accents and marks of punctuation amount to about forty. The writing is from right to left. There are three kinds of Hebrew alphabet now in use—the square or Assyrian (properly called the Babylonian), the most common; the rabbinical, or mediæval; and the cursive, or alphabet used in ordinary writing.

The extant classical Hebrew writings embrace a period of more than 1000 years from the era of Moses to the date of the composition of the books of *Chronicles*, which stand last in the Hebrew Bible. During this period the written language underwent surprisingly little change. In passing from the book of *Genesis* to the books of *Samuel* we do not recognize any very striking difference in the language. Even those who assert that the *Pentateuch* as a whole is of a comparatively late era admit the great antiquity of some of its contents, which do not differ in language from the rest. There is, indeed, to be observed a very decided difference in style and language between the earliest and the very latest Hebrew writings; but this change was sudden, hence Hebrew literature is distinguished into Pre-exilian and Post-exilian, the Babylonish captivity forming the break between the two. The writings which belong to the age subsequent to the Babylonish captivity differ very considerably from those which belong to the preceding age; the influence of the Aramaic or Chaldee language, acquired by the Jews in the land of their exile, having greatly corrupted the tongue. The historical books belonging to this age are the books of *Chronicles*, *Ezra*, *Nehemiah*, and *Esther*. In the prophets who prophesied during and after the captivity, with the exception of Daniel, the Aramaic impress is by no means so strong as we might anticipate, they having evidently formed their style on that of the older prophets. At what time Aramaic became the dominant element in the national language it is impossible to determine, but it entirely took the place of the old Hebrew as a spoken tongue. The fragments of the popular language in the New Testament are all Aramaic; and ever since the Hebrew proper has been preserved and cultivated only as the language of the learned and of books and not of common life.

After the return from the captivity, the Jewish literature was carefully cultivated. Under Ezra the Scriptures were collected, and arranged into a canon. The *Pentateuch* was publicly read, taught in schools, and translated into Aramaic. The legal or religious traditions explanatory or complementary to the law of Moses were collected and established as the oral law. These labours resulted in the *Midrash*, a general exposition of the Old Testament, divided into the *Halacha* and the *Haggada*. To the Maccabean era belong the *Apocrypha* (in Greek), various Greek versions of the Bible, and several collections of prayers, poems, and proverbs. To the succeeding epoch belong some celebrated doctors of the law—Hillel, Shammai, Gamaliel, and others; while the age following the destruction of Jerusalem (A.D. 70) witnessed the completion of the New Testament and the works of Josephus, written, however, in the Greek language. On being driven from their capital by the Romans, numerous schools were established by the Jews in which their language and literature were taught. Of these schools the most celebrated were those of Babylon and Tiberias. The *Mishna*, which contains the traditions of the Jews and interpretations of the Scriptures, is supposed to have been compiled in the latter part of the second or in the earlier part of the third century; and the rabbis of Tiberias and Babylon wrote numerous commentaries on it. These commentaries were at length collected into two separate works, the *Jerusalem* and the *Babylonian Talmuds*. The *Jerusalem Talmud* seems to have been completed about the end of the fourth century, and the *Babylonian Talmud* about a century later, under the care of Rabbi Ashe. What are called the *Targums*—that is Aramaic translations of portions of the Old Testament—belong partly to times somewhat anterior, partly to times subsequent to this period. The Jews adopted the languages of the various peoples among whom they happened to dwell, though they also wrote in classical Hebrew as well as in the less pure form of the *Rabbinical* Hebrew. The most brilliant epoch of mediæval Hebrew literature is that of the domination of the Moors in Spain. Numerous scholars, however, continued to write in Hebrew from the thirteenth century down to the present day. Towards the end of last century, with the rise of Zionism, a new patriotic effort was made to encourage the use of Hebrew both for speaking and writing, and in Palestine Hebrew has practically become a living language. Among living authors writing in Hebrew may be mentioned, among others, Asher Ginzburg (Akhad Haam) and the poet Bialik.—BIBLIOGRAPHY: Davidson, *Introductory Hebrew Grammar*; Wright, *Lectures on the Comparative Grammar of the Semitic Languages*; I. Abrahams, *Short History of Jewish Literature*; Graetz, *History of the Jews*; see also article in *Jewish Encyclopædia*.

Hebrews, Epistle to the, one of the canonical books of the New Testament, the canonicity and authorship of which have been much discussed. The immediate successors of the Apostles (Clement of Rome, Justin Martyr, &c.) seem to have considered it as of canonical authority.

Its canonicity was also maintained by St. Jerome, by the almost universal consent of the Latin and Greek Churches, and by Ambrose of Milan; while in A.D. 416 a decretal of Innocent III was issued in favour of this view. As to the authorship, the early Roman Church denied its Pauline origin. In Carthage it was (in the second century) ascribed to Barnabas, while at the same time in Alexandria it was ascribed to Paul. This view was supported by Clement of Alexandria, and Origen, the former believing that it was written by St. Paul in Hebrew, and translated into Greek by Luke. The Pauline authorship became generally accepted throughout Christendom, but in modern times the prevalent opinion is that St. Paul was not the author. The epistle was probably addressed to a Jewish section of the Roman Church, although some maintain that it was addressed to Jews of Alexandria. If the latter view be correct, Apollos, as suggested by Luther, may be the author, although tradition seems to favour the claim of Barnabas.—Cf. J. Moffat, *Introduction to the Literature of the New Testament.*

Heb′rides, or **Western Islands** (the *Heboudai* of Ptolemy, and *Hebudes* of Pliny, the *r* being an erroneous insertion), a series of islands and islets off the west coast of Scotland, usually divided into the Outer Hebrides (popularly called the Long Island), of which the principal are Lewis and Harris, North Uist, Benbecula, South Uist, and Barra; and the Inner Hebrides—Skye, Mull, Islay, Jura, Coll, Rum, Tiree, Colonsay, &c. The islands within the Firth of Clyde (Arran, Bute, the Cumbraes, &c.) are not now considered as part of the Hebrides. The Outer are separated from the Inner, and from the mainland, by a strait called the Minch, 12 miles broad. The Outer Hebrides consist of a continuous series of islands and islets, running south-west and north-east through a space of 130 miles, having Barra Head at the south extremity, and the Butt of Lewis at the north extremity. The Inner Hebrides are more widely scattered and more irregularly disposed. The Hebrides are divided between the shires of Ross, Inverness, and Argyle. They number about 520 in all, but only about 120 are inhabited; area, about 2800 sq. miles; pop. 79,159. The islands are, on the whole, mountainous, and abound in moss and moor. Although humid, the climate is mild. The soil is mostly poor, and agriculture, except in certain localities, especially Islay, is very backward. Oats and barley, with potatoes and turnips, constitute almost the entire produce of the soil. Cattle-rearing and fishing are staple industries. The land is mainly occupied by sheep-farmers, and by great numbers of crofters occupying small pieces of arable land and having often the right in common with others to a tract of rough pasture. There are also many cottars or sub-tenants, and excess of population has arisen in various localities from the minute subdivision of land. The condition of the inhabitants generally is very depressed, their dwellings miserable—the older being without chimneys or windows—and their living poor. Gaelic is the universal language, although English is tolerably well known. The Hebrides were early colonized by Norwegians, and belonged to Norway from the ninth to the thirteenth century, being annexed to Scotland in 1265. In 1346 a chief of the Macdonald clan assumed the title of 'Lord of the Isles', and he and his successors affected a sort of semi-independence, but the Hebrides were finally annexed by James V in 1540.—Bibliography: R. Buchanan, *The Hebrid Isles*; C. F. Gordon-Cumming, *In the Hebrides*; W. C. Mackenzie, *History of the Outer Hebrides.*

He′bron (anciently **Kirjath-arba** or **Mamre**, now **El-Khalil**), a town in Palestine, 18 miles south by west of Jerusalem, 2835 feet above sea-level. It lies in the narrow valley of Mamre, and was one of the three cities of refuge west of the Jordan. Its streets are narrow and dirty. A mosque, called *El-Haram*, formerly a church, erected by the Crusaders between 1167 and 1187, contains the alleged tombs of Abraham, Isaac, Jacob, Sarah, &c. Hebron is one of the oldest of existing towns. It was the residence of Abraham and the patriarchs, and at one time of David. During the European War Hebron was occupied by British troops, under General Allenby, on 7th Dec., 1917. Pop. 18,000.

Hecatæ′us of Miletus, an eminent ancient Greek historian and geographer, born (probably) about 550 B.C., died about 476 B.C. He visited Egypt, Thrace, Greece, the coasts of the Euxine, Italy, Spain, and Africa. His two great works were his *Tour of the World* (the authenticity of which is, however, questioned) and his *Genealogies* or *Histories*. Only fragments of his writings are extant.

Hec′atē, an ancient Greek goddess, whose powers were various. She could bestow wealth, victory, and wisdom; good luck on sailors and hunters; prosperity on youth and on the flocks. She was afterwards confounded with other divinities, such as Demēter, Artĕmis, and Persephŏnē (Proserpine), and finally became especially an infernal goddess, and was invoked by magicians and witches. Dogs, honey, and black female lambs were offered to her at places where three roads met. She was often represented with three bodies or three heads, with serpents round her neck. Her festivals were celebrated annually at Ægina.—Cf. L. R. Farnell, *Cults of the Greek States.*

Hec′atomb (Gr. *hecaton*, a hundred, *bous*, an ox), in ancient Greek worship literally a sacrifice of a hundred oxen, but applied generally to the sacrifice of any large number. It was necessary that the victims should be without blemish. Only parts such as the thighs, legs, or hide were burned, the rest furnishing the festive meal at the close of the sacrifice.

Heckmondwike, a town of England, county of York (West Riding), with extensive blanket, carpet, woollen cloth, and woollen yarn manufactories. Pop. 9008.

Hecla, or **Hekla**, a volcano of Iceland, about 20 miles from its south-west coast, about 5000 feet in height, and having several craters. It is composed chiefly of basalt and lava, and is always covered with snow. Many eruptions are on record. One of the most tremendous occurred in 1783, after which the volcano remained quiescent till Sept., 1845, when it again became active, and continued with little intermission till Nov., 1846, to discharge ashes, some masses of pumice-stone, and a torrent of lava. The last outbreak was in 1878.

Hector, the son of Priam and Hecuba, the bravest of the Trojans, whose forces he commanded. His wife was Andromache. His exploits are celebrated in the *Iliad*. Having slain Patroclus, the friend of Achilles, the latter sought revenge, and Hector was slain by him. The body of Hector was dragged at the chariot wheels of the conqueror; but afterwards it was delivered to Priam for a ransom, who gave it a solemn burial. Hector is the most attractive warrior in Homer's *Iliad*, in which one of the finest episodes is his parting from Andromache before his last combat.

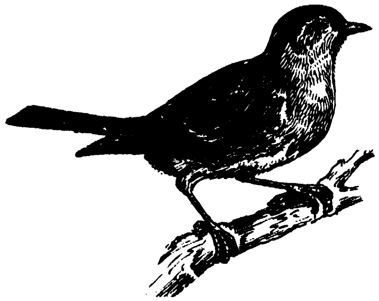
Hec'uba, of Phrygia, in Greek legend the second wife of Priam, King of Troy, to whom she bore Hector, Paris, Cassandra, Troilus, and other children. After the fall of Troy she was given as a slave to Odysseus, and, according to one form of the legend, in despair leaped into the Hellespont. There is a tragedy by Euripides entitled *Hecuba*, where a different fate is assigned to her.

Hedge, a fence formed of living trees or shrubs. Hedges are often composed of one or more of the following: hawthorn, crab, blackthorn, holly, privet, beech, hornbeam, maple, barberry, furze, broom, alder, poplar, willow, yew, box, arborvitæ, sweet-briar, &c. Although superior to dry-stone walls, they take up much room, and exhaust the soil to some extent; but they are economical, and, if properly kept, improve from year to year in efficiency and appearance. Hedges are probably more common in England than in any other country. It has been calculated that judicious trimming of hedges would increase the cultivated land in England and Wales by 400,000 acres, an effect similar to the addition of a new county of moderate size. They were not very common in England till the close of the seventeenth century. See *Barbed Wire*, *Wire*.

Hedgehog (*Erinaceus europæus*), an insectivorous mammal partly covered with spines. By means of a special muscle it is able to roll itself up into a ball, and in this form can defy most of its enemies. It has a rudimentary tail, elongated snout, short ears, with a cranium comparatively broad. The hind-feet have five toes, and strong coarse hair covers some parts of the body. The teeth are numerous. Including the tail, it attains a length of 11 inches. It usually resides in small thickets, and feeds on fruits, roots, and insects. It is fond of raw or roasted flesh, and devours cockroaches in large numbers when kept in houses. It hibernates in winter. The female bears four to six young at a birth, the young soon becoming covered with prickles. It is found in Britain and in most parts of Europe. Other species are found in Asia and Africa.

Hedgehog (*Erinaceus europæus*)

Hedge-warbler, or **Hedge-sparrow** (*Accentor modulāris*), a bird of the sub-family Sylviinæ, common in Britain and all the temperate parts of Europe. It feeds on insects, worms, and seeds; its nest is generally finished early in



Hedge-warbler, or Hedge-sparrow (*Accentor modulāris*)

March. The eggs, four or five in number, are bluish-green. The cuckoo often deposits her egg in its nest. The plumage is of a reddish-brown, streaked with dark-brown. The song of the male is short and plaintive. The length of the bird is about 5½ inches.

Hed'in, Sven, Swedish traveller and explorer, born in 1865. He studied at Stockholm and Upsala, also at Berlin and Halle, making himself well acquainted with natural science, especially geology. In 1885–6 he travelled in Persia and Central Asia, and in 1890–1, having been appointed secretary to the Swedish mission to the Shah of Persia, he took the opportunity of climbing and measuring the height of Demavend, and made an excursion to Kashgar. Supported by King Oscar II, he began in 1893 a series of exploratory journeys in Central and Eastern Asia, traversing the Pamir Plateau, the region around the Lob-Nor Lake, Northern Tibet, and after many hardships finally reaching Peking, from which he returned to Europe across North China and Siberia (1897). In 1899 he entered on a similar extended course of travel, further investigating the Lob-Nor region and the connected deserts, and attempting to reach Lhasa in the guise of a pilgrim, but being turned back by the Tibetans. On his return in 1902 he was ennobled by the King of Sweden, and received various other distinctions. In 1908 he made important discoveries in the mountainous region north of the Himalayas, the 'Transhimalayan Range'. He has produced a number of works on his travels, some translated into several languages. They include: *Through Asia* (1898); *Central Asia and Tibet* (1903); *Overland to India* (1910); *The War against Russia* (1915); and *Bagdad, Babylon, Ninivi* (1917). During the European War Sven Hedin repeatedly attacked the British in his writings, and expressed his admiration of Germany. At the request of the Kaiser he visited Belgium in 1917 to investigate the destruction caused there by the war. He abandoned the honour of K.C.I.E., which he had received in 1909, in order to anticipate his expulsion.

Hedonism (Gr. *hēdonē*, pleasure) is the philosophical theory that pleasure is the highest human good, and that every man's goal is his own happiness and pleasure. This is called ethical hedonism to be distinguished from psychological hedonism, according to which theory pleasure is the only end that can be pursued. The Cyrenaics, Epicurus, and even Hobbes and Locke, were hedonists, teaching that pleasure was the supreme end for the individual. Universalistic hedonism is the theory that not the individual's greatest pleasure, but the good of the community, is the supreme end of moral action. See *Utilitarianism*.—Cf. J. Watson, *Hedonistic Theories from Aristippus to Spencer*.

Heem (hām), Jan Davidsz de, Dutch painter of fruits, flowers, and still life, born in Utrecht in 1600, died in Antwerp in 1683 or 1684. He studied under his father, David de Heem, also well known as a painter of still life, and soon obtained large sums for his pictures, which are characterized by great delicacy and attention to detail and richness of colour. He is the chief master, and in some respects the inventor, of a highly-elaborate phase of still-life painting in the Netherlands, well represented in the Wallace Collection. His son, *Cornelius de Heem* (born 1630) imitated him, but is inferior to him.

Heemskerk (hāmz'kerk), Martin, or Van Veen, Dutch painter, born in 1498, studied in Haarlem and Rome, and settled in Haarlem, where he died in 1574. His earlier paintings are marked by the realism of the earlier Dutch painters; his later show an increasing amount of mannerism due to imitation of Michael Angelo and the antique. He was a popular painter, producing a number of pictures for public buildings, and was also an etcher and designer for wood-carving and glass-painting. Among his works are: *St. Luke Painting the Madonna*, an *Ecce Homo*, *The Crown of Thorns*, and *The Criticism of Momus*. His *Last Judgment* is in the palace of Hampton Court.

Hegel (hā'gl), Georg Wilhelm Friedrich, a celebrated German metaphysician, born at Stuttgart 1770, died 1831. He studied at the theological institute of Tübingen from 1788 to 1793, and was next a private tutor at Berne (1793–6), and subsequently at Frankfort-on-the-Main (1797–1800). Having removed to Jena, and contracted an intimacy with Schelling, he devoted himself to metaphysical study. After the battle of Jena, Hegel was employed on a newspaper at Bamberg until 1808, when he became successively rector of Nürnberg Gymnasium, professor of philosophy at Heidelberg (1816), and at Berlin from 1818 to his decease in 1831. Among his works the most important are his *Phänomenologie des Geistes* (1807), *Wissenschaft der Logik* (1812–6), *Encyclopädie der philosophischen Wissenschaften* (1817), and *Grundlinien der Philosophie des Rechts oder Naturrecht und Staatswissenschaft* (1821). The philosophy of Hegel followed that of Schelling, in adopting as a presupposition the identity of Knowing and Being, of Thought and Reality, of Subjective and Objective. But he differs from Schelling, who contemplates this identity with its inner opposites through the medium of a purely intellectual intuition, for Hegel seems rather to revert to Kant's Transcendental Logic. He thus asserts that if the order and connection of our thoughts are involved in the order and connection of things, the universal form in the course of objective action must exactly agree with the form of the development of our thoughts, and vice versa. As there are, according to him, three stages in the process of thought and existence, his system has necessarily a threefold division: logic, the philosophy of nature, and mental philosophy. Hegelianism is divided into three camps, representing respectively the supernatural, the rational, and the mystical. Hegel's philosophy has influenced British and American thought. In England the Hegelian system was expounded by E. Caird and T. H. Green. In Prussia and Germany, however, Hegelianism was influential in the domains of politics and sociology more than in any other department. The theory of might is right, as explained in Hegel's *Philosophy of Right*, found many adherents among the philosopher's own countrymen.—BIBLIOGRAPHY: R. R. Haym, *Hegel und seine Zeit*; Kuno Fischer, *Hegels Leben und Werke*; E. Caird, *Hegel*; Millicent Mackenzie, *Hegel's Educational Theory and Practice*; J. H. Stirling, *The Secret of Hegel*; A. Seth Pringle-Pattison, *Hegelianism and Personality.*

Heiberg (hī'ber*h*), Peter Andreas, Danish satirist and dramatist, born 1758, died 1841. His satiric attacks were so severe and general that he had to leave his native country, and spent great part of his life in Paris. He aimed at giving Denmark a truly national comic drama, a task which was attempted with more success by his son, Johan Ludvig (1791–1860), who was a prolific and successful dramatist, and wrote also on philosophy and æsthetics. Among his works are: *The Theatre for Marionettes*, *A Soul After Death*, and *The Newly Wedded.*

Heidelberg (hī'dl-ber*h*), a town of Baden, beautifully situated on the left bank of the Neckar, here crossed by two bridges, in one of the loveliest districts of Germany. It stands on a narrow strip between the river and the Castle-rock and Geisberg, spurs of the Königstuhl (1850 feet); and chiefly consists of one main street and less important cross and parallel streets. The principal buildings are: the church of St. Peter, the church of the Holy Ghost; the castle, anciently the residence of the Electors Palatine; the university, founded in 1386, and now possessed of a library of 500,000 volumes and attended by about 2000 students; and the town house. The castle, begun in the end of the thirteenth century, and exhibiting elaborate examples of early and late Renaissance architecture, is the most remarkable edifice in Heidelberg. It is now an ivy-clad ruin, but is carefully preserved from further decay. The principal industry is brewing. One of the greatest curiosities of the place is the Heidelberg tun, kept in a cellar under the castle. It is 36 feet in length, 26 feet in diameter, and capable of holding 800 hogsheads. Heidelberg is rich in public walks and fine views, that from the Königstuhl being of surpassing beauty. It was long the capital of the Palatinate, but was superseded by Mannheim in 1720. In 1622 Tilly captured and sacked the city. A similar fate overtook it in 1689 and 1693 at the hands of the French. Pop. 60,831 (1919).

Heidelberg Catechism, a catechism of the Reformation, drawn up by Zacharias Ursinus, in 1563, at the bidding of Frederick III, Elector of the Palatinate. Approved by the Synod of Dort in 1619, it served as the model on which the Westminster Assembly framed the *Shorter Catechism.*

Heidenheim (hī'dėn-hīm), a town of Württemberg, 46 miles E.S.E. of Stuttgart. It has manufactures of woollen and linen cloth. Pop. 18,412 (1919).

Heights, Measurement of, or **Hypsometry,** is that department of geodesy which treats of the measurement of the absolute or relative heights of various points on the earth's surface. Trigonometrical methods may be employed, or the result may be obtained by levelling, by the use of the barometer, or by the boiling-point of water as given by the thermometer. The trigonometrical method is often the only one available, as the height to be measured may be quite inaccessible. The barometric method is based on the fact that as the mercurial column is supported by the atmospheric pressure, it must fall when conveyed from a lower to a higher level, as in the latter case the pressure is diminished. Were the atmosphere uniform in density throughout, nothing could be simpler than the measurement of heights by the barometer, but gases being very compressible, the lower strata of the atmosphere are denser than the upper strata, being exposed to greater pressure. Thus a column of air 100 feet high has far greater weight at the sea-level than a similar column at the top of a mountain 4000 feet high; and the effect on the barometric column of rising 100 feet from sea-level is correspondingly greater than the effect of rising 100 feet from a height of 4000 feet above the level of the sea. Moreover, increase of temperature affects the density of the mercury in the barometer, and also that of the air, and further complicates the problem. A rule which serves for rough purposes is to multiply the difference of the logs of the barometric heights by 60,000; this gives the difference of levels of the two stations, in feet. With the help of tables of vapour pressure the barometric pressure can be deduced from observation of the boiling-point of water; the height of the station can then be calculated. For moderate heights, the boiling-point is lowered 1° F. for about every 600 feet of ascent. These barometric and boiling-point methods are not used now in accurate work, the uncertainties due to weather changes being too great. For modern methods, see *Levelling*; *Surveying*.

Heilbronn, a town of Württemberg, beautifully situated on the Neckar, quite a mediæval place in the older parts, but having modern suburbs. Its finest edifice is the old Gothic church of St. Kilian. It has flourishing industries. Heilbronn was long an imperial free town, and came into the possession of Württemberg in 1802. Pop. 44,105 (1919).

Heimdall, a divinity in the Scandinavian mythology, who keeps watch on the bridge Bifröst, which connects the domain of the Æsir or Gods with that of men. His sight and hearing are more acute than those of mortals, and nothing can evade his vigilance.

Heine (hī′nė), Heinrich, a German poet and author, was born of Jewish parents at Düsseldorf 13th Dec., 1797, and died at Paris 17th Feb., 1856. He studied law at Bonn, Berlin, and Göttingen; took his degree at the last-mentioned place, and in 1825 embraced Christianity. He afterwards lived at Hamburg, Berlin, and Munich, but in 1830 he settled in Paris, supported himself by his literary labours, and dwelt there until his death. From 1837 to the overthrow of Louis Philippe in 1848 he enjoyed a pension of 4800 francs from the French Government. Of the numerous literary works of Heine may be mentioned in particular: *Gedichte* (Poems), *Reisebilder* (Pictures of Travel), *Buch der Lieder* (Book of Songs), *Deutschland, Ein Wintermärchen* (Germany, a Winter Tale), *Shakespeares Mädchen und Frauen* (Maidens and Wives), *Die Romantische Schule, Letzte Gedichte und Gedanken* (Last Poems and Thoughts), *Atta Troll*, and *Romanzero*. As a poet Heine is remarkable for the simplicity and pathos of many of his lyric pieces. His powers of wit and raillery were also great, but he often transgressed the bounds of propriety and decorum. Scepticism and over-sensuousness are prominent characteristics. During the latter years of his life he suffered great agony from a spinal complaint, which confined him almost constantly to bed. An English translation of the works of Heine, by C. G. Leland, appeared between 1892 and 1905 (13 vols.), and a French translation in 14 vols. was published between 1852 and 1868.—Bibliography: M. Arnold, *Essays in Criticism*; G. Brandes, *H. Heine*; G. Karpeles, *Heine und seine Zeitgenossen*; H. Lichtenberger, *H. Heine, penseur*; W. Stigand, *Life, Works, and Opinions of Heinrich Heine*; W. Sharp, *Life of H. Heine*.

Heinec′cius, Johann Gottlieb, a German writer on logic, jurisprudence, and ethics, born 1681, died 1741. His works on Roman law were once highly valued.

Heinsius, Daniel, Dutch scholar, poet, and critic, born 1580, died 1655. He studied at Franeker and Leyden, at the latter under Joseph Scaliger; became professor of history and politics at Leyden in 1605, and librarian and secretary in 1607. He published editions of Hesiod, Horace, Virgil, and other classical writings, and wrote Latin and Greek poems (*Iambi*, *Elegiæ*, *Poemata*, &c.). A considerable portion of Ben Jonson's *Discoveries*, a book praised without reserve by Swinburne, is a literal translation from Heinsius.

Heir-in-Law, the person who by operation of law is entitled to succeed to the real or heritable estate of a person dying intestate. He is ascertained at the moment of death. Strictly speaking, ' no person can have an heir in his lifetime ', but he may have an heir-apparent (i.e. one who will be the heir should he survive, as the eldest son), or an heir-presumptive (i.e. one who will be the heir should he survive and no nearer heir be born, as a father or brother).

Heirloom, in English law, means some personal chattel which goes by special custom to the heir-at-law, together with the inheritance. The term is often applied to the case where certain chattels, such as pictures, &c., are directed by will to follow along with some mansion or estate.

Hejaz′, or **Hedjaz**, a kingdom of Arabia, on the shores of the Red Sea, with an area of about 100,000 sq. miles, and a pop. of about 750,000. Stretching from Akaba on the north to Asir on the south, Hejaz is bounded on the north by Syria, on the east by Nejd and the Arabian Desert, and on the south by Tehena. The Tehena Mountains reach a height of 6000 feet in Jebel Shar (Biblical Mount Seir). The north of the country is barren and desolate, and only thinly populated, but the south is more cultivated, and produces wheat, barley, and dates. Formerly a vilayĕt of the Turkish Empire, the Hejaz nevertheless enjoyed a semi-independence, and its importance and interest were, and still are, due to the fact that Mecca and Medina, the Holy Cities of Islam are within its boundaries. The Hejaz railway, connecting Damascus with Medina, begun in 1901, was completed in 1908. By means of this railway the Turks were able to maintain garrisons in the ports and in the principal towns of the interior. When the European War broke out, and Turkey joined the Central Powers, the Arabs, who always resented the presence of the Turks, whom they considered their inferiors in civilization, seized the opportunity to shake off the Turkish yoke and put an end to Ottoman dominion. The Sherif of Mecca, Hussein Ibn Ali, who, as hereditary Keeper of the Holy Places, wielded great influence throughout the Moslem world, proclaimed his independence on 5th June, 1916. The British Government had previously guaranteed him autonomy in the event of a successful revolt. The Sherif now assumed the title of King of Hejaz, and issued a proclamation to the Moslem world wherein he justified his revolt, accusing the Turks of being unfaithful to the Mohammedan religion. The Hejaz was recognized as an independent state by the Treaty of Sèvres, concluded with Turkey on 10th Aug., 1920. The capital is Mecca, and Jidda is the chief port.

Hejra, Hejira, or **Hegira** (Ar. *Hijra*), a word signifying emigration, flight, from *hajara*, to go away. The Mohammedans designate by it the flight of Mohammed their prophet from Mecca to Medina. From this flight, which happened on the 13th of Sept., A.D. 622, but which they fix on the 16th of July of the same year, they begin their computation of time.

Hel, the Norse goddess of the dead, who dwells beneath one of the three roots of the ash Yggdrasil; daughter of Loki and the giantess Angurboda. Dark rivers surround her abode; a dog watches without; the horse she rides has three feet; she herself is half black and half of fair complexion.

Helder, The, a fortified seaport of Holland, in the most northern part of the province of North Holland, opposite the Island of Texel, and commanding the entrance to the Zuider-Zee. From a fishing-town Napoleon converted it, in 1811, to a fortress and naval station of the first rank, and called it his Northern Gibraltar. Being much exposed, the port and coasts are protected by gigantic dikes, one 6 miles long and built entirely of Norwegian granite. Pop. (1919), 29,380.

Helen, or **Hel'ena,** in ancient Greek legend, the most beautiful woman of her age, daughter of Zeus by Leda. By advice of Ulysses her numerous suitors were bound by oath to respect her choice of a husband, and to maintain it even by arms. She chose Menelaus, but was afterwards carried off to Troy by Paris, the Trojan War arising from the claim made by Menelaus for the fulfilment of the oath. After the death of Paris she married his brother Deiphobus. On the fall of Troy she returned to Sparta with Menelaus, but at his death was driven from the country, and was murdered at Rhodes by the queen of the island.—BIBLIOGRAPHY: E. Oswald, *The Legend of Fair Helen*; A. Lang, *Helen of Troy*.

Hel'ena, the name of several saints, of whom the chief was the mother of the Emperor Constantine the Great, a woman of humble origin, and a native either of Bithynia or of Britain. She became the wife of Constantius Chlorus, who, however, was compelled to repudiate her when made Cæsar by Diocletian in A.D. 292. At the same time he made her son his sole heir, and Constantine, on his accession, took her to reside with him at the palace, and gave her the title of Augusta. She did much for the advancement of religion, and is said to have discovered the *true cross*, in honour of which she founded the Church of the Holy Sepulchre at Jerusalem. She died shortly after at the age of eighty, in A.D. 328 or 326.

Helena, the capital of Montana, United States, on the west side of the valley of Prickly Pear and Ten Mile Creeks, at the foot of the Rocky Mountains, 15 miles W. of Missouri River, and 110 miles N. of Virginia City. It is chiefly supported by the rich quartz and (placer) gold-mines in the vicinity. In the vicinity are hot medicinal springs. Pop. (1920), 12,037.

Helensburgh, a town of Scotland, in Dumbartonshire, prettily situated at the entrance of the Gare Loch, on the north shore of the Firth of Clyde, opposite Greenock, from which it is distant about 4 miles. It is chiefly a residential town and summer resort for Glasgow and neighbouring towns. It takes its name from Helen, wife of Sir James Colquhoun, by whom it was founded in 1777. Henry Bell, the pioneer of steam navigation, died at Helensburgh in 1830, and there is a monument to him on the esplanade. Pop. 9701.

Hel'enus, a Trojan soothsayer, son of Priam and Hecuba, twin-brother of Cassandra, and husband of Andromache after Hector's death. He foretold the destiny of Æneas, and welcomed the latter in Epirus, where he ruled after the death of Neoptolemus.

Heli'acal rising and setting, in astronomy, terms used with reference to the beginning and ending of the period during which a star (or planet) is lost to view by reason of the sun's proximity in right ascension. The heliacal setting occurs when the sun approaches so near as to terminate the season of the star's visibility in the evenings. The heliacal rising is when the star just re-emerges into view, and can be seen in the morning sky before the sun rises.

Helian'thus, a genus of Compositæ, chiefly North American annual or perennial herbs, with rough leaves and large yellow flowers, of which the common sunflower (*H. annuus*) and the *H. tuberōsus* (the Jerusalem artichoke) are examples.

Hel'icon (now **Sagara**), a mountain range of Greece, in the west of Bœotia, in some sense a continuation of the range of Parnassus. It was the favourite seat of the Muses, who, with Apollo, had temples here. In it also were the fountains of Aganippe and Hippocrene. The highest summit, now called *Paleovuni*, is barely 5000 feet high.

Helic'tis, a genus of carnivorous mammals, allied to the skunks, and including the ferret-badgers, which differ from true badgers in having the upper side of the body darker than the under. Four species are known: *H. orientalis* (Nepal and Java); *H. personata* (Burma); *H. moschata* and *H. subaurantiaca* (China). The last is strikingly coloured: head and throat chocolate above, bright orange below; back olive; under side and limbs yellowish.

Heligoland (Ger. *Helgoland,* Holy Land), an island belonging to Germany, in the North Sea, about 40 miles from the mouth of the Elbe; 1½ miles long and ½ mile broad; highest point, 200 feet. Its rocks, of reddish sandstone, present a perpendicular face to the sea, and are protected against erosion by sea-walls. Before fortification it produced some cereals and vegetables, but oysters and lobsters were the staple products, and it had a town of some 400 houses (Pop. 3400) celebrated for its sea-bathing. On account of the small amount of vegetation, Heligoland was visited in summer by many sufferers from hay fever. The inhabitants were of Frisian descent, and mainly fishers, pilots, and boarding-housekeepers. Heligoland was captured by Britain from Denmark in 1807, and ceded to Germany in 1890, in return for Germany's recognition of the supremacy of British interests in Zanzibar. It became an important strategic point and was strongly fortified by Germany, but in accordance with the Treaty of Versailles (1919) the fortress was dismantled. The naval battle of Heligoland between the Germans and the British, under Admiral Beatty, was fought on 28th Aug., 1914.

Heliodo'rus, of Emesa in Syria, a Greek romance writer. According to his own account, his father was named Theodosius, and was an hereditary priest of the sun. He himself was probably a sophist of the latter half of the third century A.D. According to the ecclesiastical historian Socrates, however, he is to be identified with a certain Bishop of Tricca, in Thessaly (*c.* A.D. 300). There is a legend that he was told by his metropolitan that he must either resign his bishopric or destroy his novel, and that he chose the former alternative. This is probably too good to be true. The romance of Heliodorus is known as the *Æthiopica,* because its opening and closing scenes are laid in Æthiopia; it is also called *The Loves of Theagenes and Chariclea.* It is written in ten books, in a poetical kind of prose. It is by far the best extant Greek romance, and offends less against good taste and decency than the works of Achilles Tatius and Longus. It had a considerable influence upon the writings of later authors, such as Tasso and Cervantes. Its plot is well managed, its characters are well drawn, and it abounds in pleasant descriptions of scenery, and vivid portrayal of manners and customs. There is a famous Elizabethan translation of the *Æthiopica,* by T. Underdowne, published in 1587. It has been reprinted in the 'Tudor' series, with an introduction by C. Whibley (1895).

Heliogab'alus, or **Elagabalus,** a Roman emperor, son of Sextus Varius Marcellus, born about A.D. 205, and originally called *Varius Avitus Bassianus.* He received his name from having been, while still a child, priest of Elagabalus, the Syro-Phœnician sun-god. After the death of Macrinus he was invested, at the age of fourteen, with the imperial purple, but his licentiousness soon displeased the populace, and he was slain in an insurrection of the prætorians, A.D. 222, after a reign of less than four years.

He'liograph, a name given to various contrivances for reflecting the sun's light either temporarily or continuously to an observer at a distance. The simplest heliograph is a mirror hung up at a distant station so as to reflect a flash to the observer, whose station may be many miles from it. This mirror is generally so adjusted that the flash occurs exactly at some pre-arranged hour, and by being in readiness the observer can get an observation with precision as regards time. Some heliographs are visible for 80 miles. By being fitted with an adjustment of clock-work, the mirror can be made to revolve with the sun, and so to reflect a beam of sunlight steadily in one direction, being then called also *heliotrope.* The principal use of the heliograph is for signalling in war.

Heliom'eter, an instrument for measuring small distances on the sky. It was originally used for measurements on the sun's disc, hence the name. It was invented by Bouguer in 1747, and improved by Dollond and Fraunhofer. In the common modern form the object-glass of the telescope is cut into two halves, relatively movable by a screw. Each half forms a perfect image in the focus of the eyepiece, and by varying the distance between the half-lenses the images may be made to diverge from, or approach, each other. If, in contemplating a celestial body which presents a real disc of circular form, the object-glasses are placed so as to bring the images to touch each other externally, the distance of the centres of the object-glasses forms a measure of the angular diameter of the image.

Heliop'olis (City of the Sun), the On, Rameses, or Beth-shemesh of the Hebrew Scriptures; now called Matarieh; situated a little north of Memphis. It was a centre of sun-worship at an early period in Egyptian history. The chief symbol of Ra, the sun-god, was a pyramidal stone in his temple. During the Fourth Dynasty the priesthood was of increasing influence. The Fifth Dynasty begins with the Ra high priest as Pharaoh, the first of a solar line of kings, and the Ptah priest of Memphis as Vizier. The legend was thereafter, until the time of Alexander the Great and later, insisted on that the Pharaoh was the physical son of the sun-god. Although Heliopolis suffered decline as a political centre after the rise of Thebes, it continued to be a centre of learning; both Eudoxus and Plato visited its famous schools. Moses was educated at On. Here Joseph and Mary are said to have rested with the infant Christ. Near the village stands the Pillar of On, 67½ feet high, and 6 feet broad at its base. Cleopatra's Needle on the Thames Embankment, London, stood in front of the great Ra temple of the ancient city before being removed in Greek times to Alexandria. The Turks were defeated here by the French in 1800.

Heliopolis, in Cœlesyria. See *Baalbek.*

He'lios, the god of the sun (Lat. *Sol*) in the Greek mythology; son of the Titan Hyperion and Theia, or Euryphæssa, and brother of Eos (Aurora, the dawn) and Selēnē (Luna, the moon). He dwells with Eos in the ocean behind Colchis, from which he issues in the morning, and to which he returns at night. His worship was extensively diffused, and he had temples in Corinth, Argos, Trœzene, Elis, but particularly in Rhodes, the Colossus of which was a representation of Helios.

He'liostat, a contrivance used in solar observation, whereby the telescope through which the observer looks can be kept fixed in one position, while the light from the sun is fed into it by apparatus arranged to move in such a manner as to follow the sun in the course of its diurnal motion due to the earth's rotation. In one form of the instrument a mirror is connected to an axis directed to the pole of the heavens, and caused to revolve from east to west at the rate of 360° in twenty-four hours. The mirror is so placed that a normal to its surface bisects the angle between the pole and the sun; thus it reflects a ray from the sun's centre in a constant direction, parallel to the earth's axis. By an additional mirror the ray may be reflected in a horizontal or any desired direction. The heliostat is largely used in connection with spectroscopic work, for eclipse observations, or with the great horizontal telescopes.

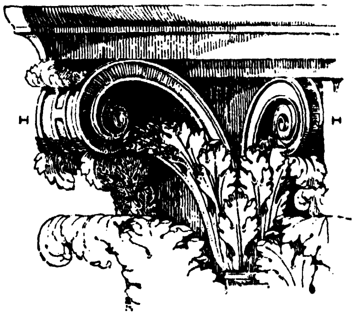
He'liotrope, a genus of plants (Heliotropium), nat. ord. Boraginaceæ. The species are herbs or undershrubs, mostly natives of the warmer parts of the world, and have alternate leaves and small flowers usually disposed in scorpioid cymes. *H. europæum*, the common heliotrope, is indigenous in the south and west of Europe, and has small white or pale-red flowers with a fruit of four drupes under a thin fleshy covering. The *H. peruvianum* is a very fragrant garden plant, growing to about 2 feet in height and bearing small lilac-blue flowers.

Heliotrope, the bloodstone, a variety of quartz, partaking of the character of jasper or of chalcedony. It is of a deep-green colour, and covered with red spots. It is hard, and is used for burnishers; the more finely-marked stones are prized for seals, and signet-rings. It is found in Tartary, Persia, Siberia; in the Island of Rum, Scotland, and elsewhere. It received the name heliotrope, or elitropia, because it was said that if the mineral were put into water in a basin rubbed with the juice of the plant heliotrope, and were exposed to the sun, the water would appear red and the sun blood-like, as if it was eclipsed. The stone rubbed with the juice of the plant was said to render its wearer invisible.

Heliotropism, or **Phototropism**, the curvature of a growing plant-organ in response to the stimulus of light. Most stems bend towards the brightest light (*positive heliotropism*), whereas leaves generally place themselves at right angles to the most intense illumination (*transverse heliotropism* or *diaheliotropism*); this behaviour on the part of stems and leaves tends to bring the foliage into the position most favourable for photosynthesis and transpiration. Similarly, primary roots, being *negatively heliotropic* as well as positively geotropic, push straight down into the soil, which is their proper medium. See *Geotropism*; *Irritability of Plants.*

Helium (from Gr. *Hēlios*, the sun), a chemical element, symbol He, originally discovered by Rayleigh and Ramsay in the chromosphere of the sun by means of the spectroscope. Ramsay afterwards discovered the element in the gases given off when certain minerals such as cleveite, monazite, pitch-blende, &c., are heated. It is contained in minute quantity in the atmosphere, and in larger quantity in American natural gas. From this source Ramsay, in 1915, showed it possible to isolate considerable quantities. Helium is a colourless gas which liquefies at −268·8° C.; it is non-inflammable, and next to hydrogen is the lightest gas known. The α-particles expelled from radium are atoms of helium which have lost two electrons. After it was found possible to isolate the gas in quantity, Ramsay proposed its use in air-craft, as its lifting power is almost as great as that of hydrogen, and it has the advantage over the latter in being non-inflammable. It was produced in considerable quantities in Canada during the European War, for this purpose. Helium is very valuable as a thermometric substance in high-class gas thermometry, for it has practically no chemical affinity, it is monatomic, and possesses an extremely low liquefaction point. It is now coming into general use for work at low temperatures, but at high temperatures it, like hydrogen, readily diffuses through quartz and glass.

Helix, (1) a spiral line shaped like a spiral spring with a straight axis. The line is formed by the edge of an inclined plane, which is wrapped round a circular cylinder so that the base of the inclined plane lies always in the end plane of the cylinder. (2) In architecture, a small volute or twist under the abacus of the Corinthian capital, of which in every perfect capital there are sixteen, two at each angle, and two meeting under the middle of each face of the abacus.



Part of a Corinthian Capital showing three Helices
H, Helix

Hell. See *Immortality.*

Helladothe′rium, an extinct genus of ungulate quadrupeds allied to the existing giraffe. Fossil remains occur in the Upper Miocene rocks of Attica and Northern India.

Hellas, or **Hellenes**. See *Greece.*

Hel′lebore (Hellebŏrus), a genus of plants, nat. ord. Ranunculaceæ, consisting of perennial low-growing plants with palmate or pedate leathery leaves, yellowish, greenish, or white flowers, having five conspicuous persistent sepals, eight to ten small tubular petals, and several many-seeded carpels. *H. orientālis* is the species which produced the black hellebore of the ancients, considered by them to be the best of all cures for madness (Horace, *Satires*, ii, 3, 80, *Ars Poetica*, 300). Anticyra in Phocis was famous for its hellebore, hence *naviga Anticyram* (sail to Anticyra) was a polite way of indicating mental alienation in the person addressed. *H. niger*, the Christmas-rose common in gardens, is a native of South and East Europe, and is the source of the black hellebore of modern pharmacopœias. *H. viridis* and *H. fœtidus* are herbaceous plants with green flowers, and grow in Britain; their leaves are emetic and purgative. The whole of these plants are accounted purgative, and in large doses act as a narcotic acrid poison; but they are now little used in medicine. *Veratrum album*, ord. Liliaceæ, a very different plant, is known as white hellebore. It is extremely acrid, and in the form of powder is used to destroy caterpillars and household vermin.

Hellen, in Greek mythology, son of Deucalion and Pyrrha, and founder by his three sons, Dorus, Æolus, and Xuthus, of the four great branches of the Greek people or Hellenes.

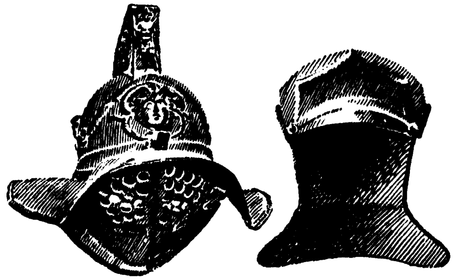
Hellenists, a name for those Jews who, especially in Egypt after the time of Alexander the Great, became imbued with Greek culture and civilization, and spoke and wrote in Greek. To them was due the formation of the peculiar dialect termed the *Hellenistic* dialect of Greek, the special feature of which was its use of foreign, and more particularly of Hebrew and Aramaic words and idioms. The most noted of the Jewish Hellenistic philosophers was Philo of Alexandria, and the chief of the learned labours of the Alexandrian Jews was the *Septuagint* version of the Old Testament.

Hellespont. See *Dardanelles.*

Hellevoetsluis (hel′vụt-slois), a fortified seaport of the Netherlands, province of South Holland, 18 miles south-west of Rotterdam, on the Haringvliet, the largest mouth of the Rhine. William III embarked here for England in 1688. Pop. 4355.

Hell Gate, a formerly dangerous pass in East River, the strait which connects New York Bay with Long Island Sound. Rocks here used to form an obstruction much dreaded by mariners, but by extensive submarine mining operations, and the use of the most powerful explosives, the passage was practically cleared in 1886. A steel arch bridge across East River at Hell Gate has been constructed.

Helmet, an article of armour for the protection of the head, composed of leather or of metals. Some of Homer's heroes are represented as wearing brazen helmets, with towering crests. Among the Romans the *cassis* was a metallic helmet; the *galea*, a leathern one. The earlier Greek and Roman helmets did not protect the face. During the Middle Ages helmets were made of steel, frequently inlaid with gold, and provided with bars and flaps to cover the face



Roman Helmets

The one on the left has a perforated visor and has a ridge on the top to which a crest or plume of horse-hair was fastened.

in battle and to allow of being opened at other times. The full-barred helmet entirely covered the head, face, and neck, having in front perforations for the admission of air, and slits through which the wearer might see the objects around him. The open helmet covered only the head, ears, and neck, leaving the face unguarded. Some open helmets had a bar or bars from the forehead to the chin, to guard against the transverse cut of a broadsword. The modern military helmets worn in full-dress afford no protection for the face. Firemen wear a heavy head-piece of leather and brass, or other materials, to protect them as far as possible from falling ruins at conflagrations. Helmets of white felt, with folds of linen wrapped round them, are worn in India and other hot climates as a protection against the sun. The name helmet is also given to a kind of hat worn by policemen. In *heraldry* the helmet is borne over a coat of arms, and the form and position of it vary according to the quality or dignity of the bearer. (See *Heraldry.*) In 1916 the steel shrapnel helmet, colloquially known as a ' tin hat ', was introduced into the British army. A similar helmet was eventually worn by all the combatant armies; it saved a large number of casualties.

Helmet-shell, the common name of sea-snails belonging to the genus Cassis, the type of a special family (Cassididæ). Most of the species are inhabitants of tropical shores, but a few are found on the coast of the Mediterranean. Some of the shells attain a large size. Those of *C. rufa*, *C. cornuta*, *C. tuberosa*, and other species, are the material on which shell cameos are usually sculptured.

Helmholtz, Hermann-Ludwig Ferdinand von, German physiologist and physicist, born 1821 at Potsdam, died in 1894. Educated at Berlin, he became professor of anatomy at the Academy of Fine Arts in 1848, and in 1849 he obtained the chair of physiology at Königsberg, from which he was successively transferred to the same post at Bonn (1855) and at Heidelberg (1858). In 1871 he was appointed professor of physics at Berlin. His work was chiefly in those departments of physics which are in closest relation with physiology, notably in acoustics and optics. Of his many publications the best known are: *The Conservation of Force* (1847), *Manual of Optics* (1856–66), *Popular Lectures on Scientific Subjects* (London, 1873 and 1881), and *Sensations of Tone as a Physiological Basis for the Theory of Music* (1862, London 1875). He was ennobled by the German Emperor in 1883.—Cf. J. G. McKendrick, *H. L. F. von Helmholtz.*

Helminthospo'rium, a genus of Fungi Imperfecti, section Hyphomycetes. Several species are troublesome parasites, notably *H. turcicum*, which often proves destructive to Indian corn, and *H. gramineum*, the cause of ' leaf-stripe ' and ' blind ears ' in barley.

Helmond, a town of Holland, province of North Brabant, on the Aa, with industries of several kinds. There is an old château dating from 1403. Pop. 15,147.

Helmont, Jean Baptiste van, Belgian physician and chemist, born in 1577 at Brussels, died in 1644. In his seventeenth year he gave public lectures on surgery at Louvain. Perceiving the defects of the system of Galen, he announced his intention of reforming medicine, but finally renounced its practice, and travelled for ten years. He was then induced by an empirical chemist to take up the study of chemistry, and his medical tastes reviving, he retired to Vilvorde, near Brussels, where he occupied himself till his death with medical labours. He boasted of having found the means of prolonging life, composed visionary theories on the constitution of man, and on diseases, and made some genuine discoveries in chemistry. Van Helmont was the first to introduce the term *gas* into science, and was also the first to observe the acid reaction of the gastric juice. The system of van Helmont resembles that of Paracelsus, but is more clear and scientific. The Emperors Rodolph II, Matthias, and Ferdinand II, invited him to Vienna, but he preferred the independence of his laboratory. His works were published at Amsterdam under the title *Ortus Medicinæ, vel opera et opuscula omnia* (1668).

Helmstedt, or **Helmstädt** (helm'stet), a town in Brunswick, 20 miles E.S.E. of Brunswick; formerly a member of the Hanseatic League. There are a fine church of the twelfth century, and buildings in the Romanesque style, formerly accommodating a university, founded in 1576 and closed in 1809. Pop. 16,420.

Helmund, a river in Afghanistan, which it traverses diagonally north-east to south-west, and ultimately falls into the extensive Lake Hamoon, after a course of about 550 miles. Its source is 11,500 feet above sea-level.

Heloder'ma, a North American genus of lizards, of which the Mexican species, *H. horridum*, has been proved to be venomous, all its teeth being furnished with poison glands. It is about 2 feet in length, has a thick and squat body covered with rough scales, forms burrows under the roots of trees, is nocturnal in habit, and is said to feed on insects, worms, centipedes, frogs, and lizard eggs. The coloration, orange and blackish brown, is of ' warning ' kind. The only other species (*H. suspectum*), known as the Gila monster, is native to New Mexico and Arizona.

Heloise, or **Eloise** (el-o-ēz), celebrated for her beauty and wit, but still more on account of her love for Abelard, was born in Paris in

1101, and died in 1164. After the mutilation of her lover she was persuaded by him to take the veil at Argenteuil, and ultimately became prioress of the convent there until 1129, when she entered, with some of her nuns, the oratory of the Paraclete, built by Abelard at Nogent-sur-Seine, where she lived in exemplary piety. Contemporary writers speak in high terms of her genius. She understood Latin, Greek, and Hebrew, was familiar with the ancients, and well read in philosophy and theology.

He'lots, slaves in ancient Sparta, the lowest of the four classes into which the population of the city was divided. They were the property of the State, which alone had the disposal of their life and freedom, and which assigned them to certain citizens, by whom they were employed in private labours. Agriculture and all mechanical arts at Sparta were in their hands, and they were also obliged to bear arms for the State in case of necessity. They behaved with great bravery in the Peloponnesian War, and were rewarded with liberty (431 B.C.), but 2000 appear to have been subsequently secretly massacred. They several times rose against their masters, but were always unsuccessful and finally reduced.

Helps, Sir Arthur, English essayist and historian, born 1813, died in 1875. He graduated at Cambridge in 1835, and from 1859 until his death was clerk of the Privy Council. His works, which are for the most part of a pleasant moralizing type with many indications of a fine, if not of a robust personality, comprise an early volume of essays; *Thoughts in the Cloister and the Crowd* (1835); *Catherine Douglas, a Tragedy* (1839); *Essays written during the Intervals of Business* (1841); *Claims of Labour* (1844); the series entitled *Friends in Council* (1847–59); *Companions of my Solitude* (1851); *Brevia* (1871); *Conversations on War* (1871); *Thoughts on Government* (1872); *Animals and Their Masters* (1873); *Social Pressure* (1875); *The Spanish Conquest of America* (1855–61); *Life of Pizarro* (1869); *Life of Cortes* (1871); *Realmah, a Romance* (1868); and *Ivan de Biron, a Russian story* (1874). He also edited the Prince Consort's *Speeches* (1862), and the Queen's *Leaves from a Journal* (1868), receiving knighthood (K.C.B.) in 1872.

Helsingborg, a seaport in Sweden, at the narrowest part of the Sound, opposite Elsinore. It has manufactures of leather, dyeworks, tileworks, saltworks, and a spacious harbour. Pop. 45,330.

Helsingfors (Helsinki), a seaport, capital of the Republic of Finland, on a peninsula in the gulf of that name, 180 miles W.N.W. of Petrograd. It is the seat of important courts and public offices, and contains a university, removed from Åbo in 1827. It has manufactures of linen, sail-cloth, and tobacco, an important trade in timber, corn, and fish, and one of the best harbours in the Baltic. Pop. (with Suomenlinna), 187,544 (1919).

Helsingör. See *Elsinore*.

Helst, Bartholomew van der, Dutch portrait-painter, born at Haarlem in 1611 or 1612, died at Amsterdam 1670, where and at Rotterdam and the Hague he worked. His single portraits, such as the *Paul Potter* at the Hague, are his best works; though his picture of a banquet of a company of the civic guard in the Stadthouse at Amsterdam was called by Sir Joshua Reynolds "perhaps the first picture of portraits in the world".

Helston, a municipal, and until 1885 parliamentary borough of England, county of Cornwall, on an acclivity on the left bank of the Cober, 9 miles s.w. of Falmouth. Principal industries: mining and shoemaking; and there is some shipping trade from Port Leven, 3 miles distant. Helston is famous for its celebrations on 8th May, known as Furry Day. The principal part of the ceremony consists in dancing through the houses. Pop. 2616.

Helvel'lyn, one of the highest mountains of England, county of Cumberland, between Keswick and Ambleside; height, 3313 feet.

Helvet'ic Confession, the name of a document drawn up by Martin Bucer and others in 1536 to settle the controversy between the Lutherans and the Zwinglians; and also of one drawn up by Bullinger (in 1562, and revised in 1564) at the request of Friedrich III, Elector of the Palatinate, and adopted in Switzerland, the Palatinate, France, Hungary, Poland, and Scotland. Next to the Heidelberg Catechism, the Helvetic Confession is the most generally recognised Confession of the Reformed Church.

Helve'tii, anciently a Gallic or Celtic people dwelling in the country now nearly corresponding with Switzerland. They were not much known to the Romans until the time of Julius Cæsar, who, as Governor of Gaul, prevented their intended emigration, and after many bloody battles pressed them back within their frontiers. After their subjection by Cæsar several Roman colonies were established amongst them. On the death of Galba, the Helvetii, for refusing to acknowledge Vitellius as emperor, were mercilessly punished by Cæcina, one of his generals.

Helvétius (el-vā-si-ůs), Claude Adrien, French philosophical writer, born in 1715, died in Paris in 1771. Having made a fortune as a farmer-general, he devoted himself to philosophic work. In 1758 he published his one important book, *De l'Esprit* (On the Mind), the materialism of which drew upon him many attacks. It was condemned by the Sorbonne, and publicly burned by decree of the Parliament of Paris. In 1764 he went to England, and the year afterwards to

Germany, where Frederick the Great and other German princes received him with many proofs of esteem. He also wrote a work, *De l'Homme*, and an allegorical poem, *Le Bonheur*. As a philosopher Helvetius belonged to the Utilitarian school.—Cf. A. Keim, *Helvétius, sa vie et son œuvre*.

Helwān′, a health-resort in Egypt, about 14 miles south-east of Cairo, with warm sulphur, saline, and chalybeate springs, which now attract many visitors. There are a well-equipped bath-house, hotels, lodging-houses, &c. The place is an artificial oasis, to which water is conveyed from the Nile, 3 miles to the west. It is highly suitable as a winter residence.

He′mans, Felicia Dorothea, maiden name Browne, English poet, born at Liverpool in 1793, died in 1835. She first appeared as an author in 1808, with a volume entitled *Early Blossoms*, which was followed in 1812 by her more successful volume *The Domestic Affections*. In the same year she married Captain Hemans, who, however, left her six years later, shortly before the birth of her fifth son. She then devoted herself to literature, winning public notice by her poems entitled *The Restoration of the Works of Art to Italy*, *The Sceptic*, *Modern Greece*, and *Dartmoor*, the last, in 1821, gaining the prize of the Royal Society of Literature. In 1825 she took up her residence at Rhyllon, near St. Asaph, where she wrote her *Lays of Many Lands*, *Forest Sanctuary*, and *Records of Woman*. In 1828 she changed her residence to Wavertree, near Liverpool, where, in 1830, she published one of her most popular volumes, entitled *The Songs of the Affections*. In 1831 she removed to Dublin, where she published her *Hymns for Childhood*, *National Lyrics and Songs for Music*, and *Scenes and Hymns of Life*. Her poetry is essentially lyrical and descriptive, and is always sweet, natural, and pleasing. In her earlier pieces she was imitative, but she ultimately asserted her independence, and produced many short poems of some beauty and pathos.

Hem′atine, or **Hæmatine**, the red colouring-matter of the blood occurring in solution in the interior of the blood corpuscles or cells. It is the only structure of the body, except hair, which contains iron.

Hem′atite, or, more correctly, **Hæmatite**, an important ore of iron, taking its name from its dull blood-red streak. Its composition is Fe_2O_3, and its crystals are trigonal, with a brilliant metallic lustre: they appear black, but the characteristic colour is revealed on powdering. *Specular iron ore* is a name for crystallized varieties. Commonly the ore is concretionary and mammillated, showing fibrous structure and a deep purple-red colour. *Limonite* (q.v.) is often called brown hematite, but contains only some 56 per cent of iron as against 70 per cent in true hematite. The hematite crystals of Elba are especially famous.

Hemel Hempstead, a market town and municipal borough of England, Herts, 6 miles west of St. Albans, carrying on paper-making, iron-founding, straw-plaiting, &c. Pop. 13,832.

Hemeralo′pia is a term at one time used for night-blindness, a defect of vision whereby the person loses his sight at night. As it was also used for the reverse condition, day-blindness, its use has been largely discontinued.

Hemerobi′idæ, the ant-lions, lace-wing flies, &c., a family of neuropterous insects, noted for their predaceous larvæ. Those of ant-lions (species of Myrmeleon, &c.) dig conical pitfalls in sandy soil for catching ants and flies. The lace-wing flies (species of Chrysopa), small fragile forms with eyes shining like metal, are common in Britain, and their larvæ prey upon Aphides.

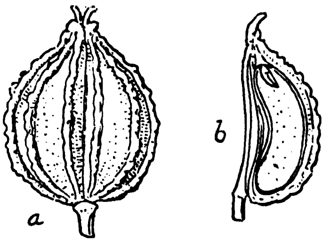
Hemileia, a genus of Fungi, family Uredineæ (rusts), closely allied to Uromyces. *H. vastatrix*, the coffee-leaf disease or coffee-rust, is a terrible scourge in coffee plantations. It is difficult to check, and in Ceylon, where it first spread to coffee from certain wild host-plants, has been responsible for damage estimated at many millions of pounds sterling.

Hemip′tera, bugs, an ord. of four-winged insects, having a suctorial proboscis, the outer wings, or wing-covers, either entirely formed of a substance intermediate between the elytra of beetles and the ordinary membranous wings of most insects, or leathery at the base and transparent towards the tips. In one group (Aphides) all the wings when present are membranous. The true wings are straight and unplaited. Some feed on vegetable and some on animal juices. Those having the upper wings of a uniform substance throughout (whether leathery or transparent) have been constituted into a section, and by some naturalists into an order named Homoptera; those having them partly leathery and partly transparent constitute the section or ord. Heteroptera To the Hemiptera belong the plant-lice, boat-fly, cochineal and other scale-insects, bed bug, lantern-fly, &c.

Hem′isphere, half a sphere, especially one of the halves into which the earth may be supposed to be divided. It is common to speak of the Eastern Hemisphere and the Western Hemisphere, the former, also called the Old World, comprising Europe, Asia, Africa, Australia, &c.; the latter, North and South America, &c. The boundary between the two is quite arbitrary, and a more natural division of the earth is into the northern and the southern hemisphere, the equator forming the dividing line.

Hemlock, a poisonous plant, *Conium macula-*

tum, nat. ord. Umbelliferæ, supposed to be identical with the plant *kōneion* of the Greeks. It is a tall, erect, branching biennial, with a smooth, shining, hollow stem, usually marked with purplish spots, elegant, much-divided leaves, which when bruised emit a nauseous odour, and white flowers in compound umbels of ten or more rays, surrounded by a general involucre of three to seven leaflets. It is found in Britain and throughout Europe and temperate Asia in waste places, banks, and under walls. It is said to be fatal to cows when they eat it, whereas horses, goats, and sheep may feed upon it without danger. In the human subject it causes paralysis, convulsions, and death. The poison administered to Socrates is supposed to have been a decoction of it, though others are of opinion that the potion was obtained from water-hemlock (*Cicūta virōsa*). Hemlock is a powerful sedative and is used medicinally. The extract is considered the best preparation. It is often serviceable as a substitute for, or an accompaniment to opium. It has been found very useful in chronic rheumatism and in whooping-cough, and in allaying the pain of irritable sores and cancerous ulcers. The virtues of hemlock are due to the alkaloid coniine.



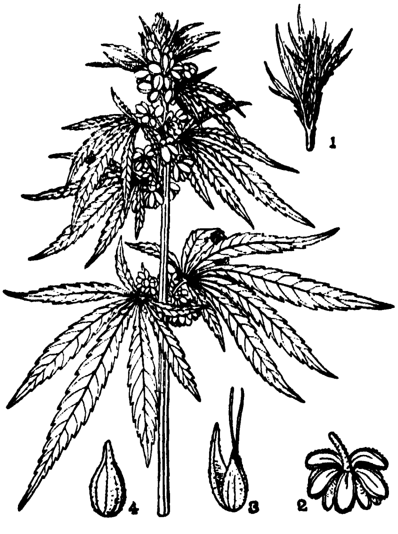
Fruit of Hemlock (*Conium maculatum*)

a, Exterior view. *b*, Section.

Hem′orrhage is a flow of blood from the blood-vessels from any cause. Hemorrhage from different parts and organs of the body is given special names, hemoptysis, hematemesis, hematuria, epistaxis, while the terms accidental, postpartum, and unavoidable hemorrhage are used with reference to the separation of the placenta in pregnancy and parturition. The treatment varies with the cause and situation of the hemorrhage. See *Hæmaturia* and *Hæmoptysis*.

Hem′orrhoids, or **Piles**, are a varicose condition of the veins surrounding the anus and lower part of the rectum. In the mild form the condition is very common, and when more severe causes much pain and discomfort, requiring an operation for relief. The predisposing causes are sedentary occupation, alcoholic excess, and chronic constipation. The mild form may be present for a long time without producing much discomfort, but severe symptoms may be brought on by the use of drastic purgatives, sudden exposure to cold or damp, congestion of the liver, or a chill. The hemorrhoids may be either external or internal, or both conditions may be present together. When the internal variety is alone present, hemorrhage from the rectum is often the first sign, and this hemorrhage becomes gradually more frequent and severe. Treatment consists of avoidance, as far as possible, of the predisposing causes, especially chronic constipation, and when the condition is well established operation for removal of the hemorrhoids is the only satisfactory course.

Hemp (*Cannăbis satīva*), a plant, the only known species of the genus Cannăbis, nat. ord. Moraceæ. It is an annual herbaceous plant; the leaves are divided into five lanceolate and coarsely-serrate leaflets; the male flowers, which are on separate stems, are green, resembling those of the hop; the female flowers are inconspicuous, and the fruit is a little hard capsule containing a single seed. It is a native of Western and Central Asia, but has long been naturalized in Brazil and tropical Africa, and is extensively cultivated in Italy and many other European countries, particularly Russia and Poland. The Indian variety, often known as *Cannăbis indica*, is the source of the narcotic drug variously known as *hashish*, *bhang*, or *gunjah*. The hemp fibre is tough and strong,



Hemp Plant (male)

1, Female spike. 2, Male flower. 3, Female flower. 4, Fruit.

and peculiarly adapted for weaving into coarse fabrics such as sail-cloth, and for twisting into ropes and cables. The finer sorts are used for shirtings, sheetings, &c., which, though coarser than those made from flax, are very much stronger and equally susceptible of being bleached. The hemp of England is much superior, but the plant does not pay the farmer, and very little of it is grown. In some of the United States it is a crop of considerable importance. The seed must be sown thin, not more than 1 to 2 bushels to an acre. Small paths are often left open along the field lengthwise, about 7 feet distant from each other, to allow the plucking of the male plants first, as the female require to remain standing a month longer to admit of the seed becoming ripe. But in some parts the whole crop is cut at once, plants for seed being separately cultivated. The plant being stripped of its leaves, and dried in the open air, may be stored, but when steeped green it turns out of a better colour. The steeping takes from four to eleven days, and the operation is known to be completed by the inner *reed* or woody fibre separating easily from the fibres of the outer bark. When thoroughly steeped, it is taken out of the water and spread out in rows on the grass to bleach. This takes three weeks or more, during which period it requires constant turning with a light, long pole. After drying it is scutched or broken by breaks and scutching-stocks, resembling those employed for flax. Beating is the next operation, which separates the 'boon' from the fibre. The hemp is now ready for being heckled, after which it may be spun. Hemp-seed is much used as food for cage-birds, and also yields an oil. Sisal hemp or 'henequen' and Manila hemp are not true hemps.

Hems, or **Homs** (Rom. *Emesa*), a town of Syria, on the railway running northwards from the Beyrout-Damascus line. It has manufactures of cotton, silk, &c., and an active trade. In this locality Zenobia was defeated by Aurelian in A.D. 272; and the Turkish forces by Ibrahim Pasha in 1832. Pop. 70,000.

Henbane, a plant of the genus Hyoscyămus, nat. ord. Solanaceæ. The only British species is *H. niger* a native of Europe and Northern Asia. It is a coarse erect biennial herb, found in waste ground and loose dry soil, having soft, clammy, hairy foliage of disagreeable odour, pale yellowish-brown flowers streaked with purple veins, and a five-toothed calyx. The expressed juice of the leaves and seeds contains several alkaloids, and is often used as a sedative, antispasmodic, and narcotic, having in many cases the great advantage over laudanum of not producing constipation. When taken in considerable quantity, it proves quickly fatal to man and most animals, particularly to domestic fowls, whence the name. Called also *Stinking Nightshade.*

Hendon, an urban district of Middlesex, forming a suburb of London, north-west of Hampstead. It gives name to a parliamentary division of the county. Mill Hill Grammar School and a Roman Catholic Missionary College are here. Hendon is now an aviation centre, and there are flying-schools and aeroplane-works. Pop. 56,014.

Henbane (*Hyoscyămus niger*)

1, Capsule, with lid opening and seeds falling out.
2, Lower part of corolla opened out.

Hengest, a prince of the Jutes, founder of the Kingdom of Kent in Great Britain, in conjunction with his brother Horsa. In A.D. 449 the Britons sued for aid from the Saxons against the inroads of the Scots and Picts. The Saxons under Hengest and Horsa accordingly landed at the mouth of the Thames, and defeated the northern tribes near Stamford in A.D. 450. Being reinforced from home, they afterwards united with the Scots and Picts against the Britons, whom they ultimately dispossessed. Hengest, who had lost his brother in the battle near Eglesford (now Ailsford) in A.D. 445, founded the Kingdom of Kent, established his residence in Canterbury, and died about the year 488. By some writers the brothers are, with insufficient reason, regarded as mythical personages.

Hengstenberg, Ernst Wilhelm, German divine and commentator, born in 1802, died in 1869.

He was long professor of Old Testament exegesis at the University of Berlin. His influence as leader of the orthodox party was established by the publication of the *Evangelische Kirchenzeitung* (1827), of which he was editor, and which had for contributors Otto and Ludwig von Gerlach, Neander, Tholuck, Lange, Huber, Stahl, Vilmar, and Leo. His works include a translation of Aristotle's *Metaphysics*; a *Christology of the Old Testament*, and *Introduction to the Old Testament*; a *Commentary on the Psalms*; *The Revelation of St. John*; a *History of the Kingdom of God in the Old Testament*; &c.—Cf. F. Lichtenberger, *History of German Theology in the 19th Century.*

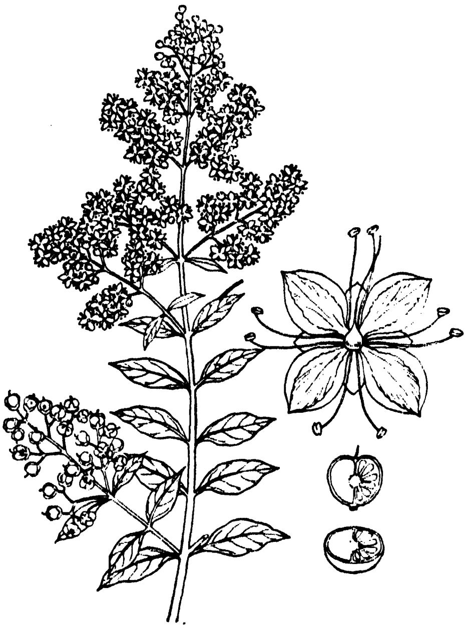
Henley, William Ernest, English poet, critic, and journalist, born 1849, died 1903. He took up journalism, and edited the magazines *London*, *Magazine of Art*, *Scots Observer* (later *National Observer*), and lastly the *New Review* (1893-7). His first publication, *In Hospital: Rhymes and Rhythms* (1888), was inspired by his own experiences as a patient in Edinburgh Infirmary, in which city he met and became a friend of Robert Louis Stevenson, his collaborator in several plays. *A Book of Verses* appeared in 1890, *The Song of the Sword and other Poems* in 1892, and a collected edition of his poems in 1898, followed by a fresh volume of verse, *For England's Sake*, in 1900. He did much editorial work in connection with both prose and poetry, including that done for *The Centenary Burns* in conjunction with T. F. Henderson, the most important outcome of which was an elaborate and illuminating estimate of Burns as a poet and as a man. He also edited *Lyra Heroica*, an anthology of verse.

Henley-on-Thames, a municipal borough of England, in Oxfordshire, on the left bank of the Thames, here crossed by a handsome bridge, 35 miles W. of London, giving its name to a parliamentary division of the county. It is famed for its annual regatta. Pop. 6841.

Henna, a shrub (*Lawsonia inermis*), nat. ord. Lythraceæ, bearing opposite entire leaves and numerous small white fragrant flowers disposed in terminal panicles. Externally it bears considerable resemblance to the European privet. It grows in moist situations throughout North Africa, Arabia, Persia, and the East Indies, and has acquired celebrity from being used by the inhabitants of those countries to dye yellow the nails of their fingers and the manes, hoofs, &c., of their horses. It is cultivated extensively in Egypt, and the powdered leaves form a large article of export to Persia and the Turkish possessions. It may be used for dyeing woollens, not only yellow, but brown, when alum and sulphate of iron are employed.

Hennebont (en-boṇ), an ancient seaport, France, department of Morbihan, on the Blavet, 27 miles W.N.W. of Vannes. Pop. 9000.

Henrietta Maria, queen of Charles I of England; youngest child of Henry IV of France by his second wife, Maria de' Medici; born in Paris 1609, died at Colombes, near Paris, in 1669. The proposed marriage between Charles, Prince of Wales, and the Infanta of Spain having failed, a matrimonial negotiation was opened with Henrietta, whom he had first met at a ball in Paris while on his way to Spain. The marriage was celebrated by proxy at Paris in 1625, but her popularity in England was soon destroyed by her bigotry, hauteur, and despotic ideas as to divine right. Much of the subsequent procedure which brought Charles to the block may be traced indirectly to her influence. On the breaking out of civil war she proceeded to Holland, procured money and troops, and afterwards joined Charles at Oxford. She again went to the Continent in 1644, and resided in France till the Restoration. On that occasion she visited England, but soon returned to France, where she died.—Cf. I. A. Taylor, *The Life of Queen Henrietta Maria.*



Henna (*Lawsonia inermis*) with details of flower and fruit

Henry I of Germany, surnamed *The Fowler*, according to tradition because his election to the German Empire was announced to him while fowling. He was the son of Otho the Illustrious, Duke of Saxony, was born in A.D. 876, and died in 936. On the death of his father he became Duke of Saxony and Thuringia, was elected Emperor of Germany in 919, and was the true founder of the empire. By his prudence and activity Suabia and Bavaria were forced to tender allegiance, and Lorraine was reunited to the German Empire in 925. He was defeated, however, by the Hungarians, and forced to pay a yearly tribute to obtain a truce for nine years. He spent this period in developing a sound military organization, and turning his arms against various Slavonic tribes in the south, was everywhere victorious. At the end of the truce with the Hungarians he refused the tribute, and completely routed them in 933. Besides his military reforms he diminished the feudal privileges, and granted to the cities of the empire their first municipal charters.—Cf. G. Waitz, *Jahrbücher des deutschen Reichs.*

Henry II, *The Saint*, Emperor of Germany, born 972, died in 1024. A son of Henry the Quarreller of Bavaria, and great-grandson of the Emperor Henry I, he inherited Bavaria in 995, and on the death of Otho III in 1002 laid claim and was elected to the empire. He had to proceed to Italy to assert his sovereignty there, the Lombard cities having chosen Harduin of Ivrea as their king. During his absence Boleslas of Poland extended his sway over the whole of Bohemia, but after repeated campaigns Henry succeeded in recovering Bohemia, and in 1018, in the Peace of Budissin (Bautzen), reduced him to complete subjection. In the midst of these campaigns against Boleslas he made another expedition into Italy (1013) against Harduin. On this occasion Henry was crowned emperor by Pope Benedict VIII. He made a third expedition into Italy in 1022 to aid Benedict against the Greeks.

Henry III, Emperor of Germany, the second belonging to the House of the Salian Franks, son of the Emperor Conrad II, born in 1017, died in 1055. He was chosen king in 1026, and succeeded his father in the imperial dignity in 1039. He weakened the power of the great feudal lords, and forced the Duke of Bohemia in 1042, and the King of Hungary in 1044, and again in 1047, to accept their dominions as imperial fiefs. His influence was also paramount in Italy, especially in Milan, and in the south, where the Normans in Apulia and Calabria paid him homage. In 1046 he deposed the rival Popes Benedict IX, Sylvester III, and Gregory IV, and caused Suitger, Bishop of Bamberg, to be elected in their stead as Clement II. His efforts to secure the permanence of the influence of the empire over the See of Rome were thwarted by Cardinal Hildebrand (Gregory VII). His first wife was a daughter of Canute the Great of England.

Henry IV, German Emperor, son of Henry III, was born in 1050, died in 1106. At the death of his father he was only five years old, and his whole life was a series of troubles, partly of his own causing. His severe treatment of the Saxons led to a rising which was cruelly punished. His treatment of the conquered people was such that they complained to the Pope, and Gregory VII (Hildebrand) accordingly summoned Henry, in 1076, to appear before him at Rome and answer the charges, at the same time forbidding the sale of ecclesiastical dignities. Henry not only disregarded the threat, but instigated the bishops, assembled by his order at Worms, to renounce their obedience to the Pope. Gregory, however, pronounced sentence of excommunication against him, and Henry, finding himself deserted, was obliged to go to Italy and make his submission to the Pope (1077). The insolence with which the Pope used his victory produced a reaction; the Italian princes, who had long been dissatisfied with Gregory, offered Henry their assistance. The German princes, however, at the instigation of the Pope, elected Rudolph, Duke of Suabia, king. Henry hastened back to Germany and overcame his rival, who lost his life in 1080. Gregory again excommunicated Henry; but at the Council of Brixen, in 1080, he was deposed by the German and Italian bishops as a heretic and a sorcerer, and Guibert, Archbishop of Ravenna (Clement III) set up in his place. In 1084 Henry succeeded in establishing Clement at Rome, but was obliged to return to Germany to maintain his ground against two rivals who successively arose. In 1085 Henry was again obliged to cross the Alps in aid of his protégé Clement III. But the dissatisfaction against him in Germany had not subsided, and though he succeeded in crushing the rebellion of his eldest son, Conrad, who died deserted at Florence in 1101, his second son, Henry, made himself master of his father's person in 1105 by strategem, and compelled him to abdicate the throne at Ingelheim. Henry IV ended his life and his sorrows in neglect at Liége.—Cf. H. Floto, *Kaiser Heinrich IV und sein Zeitalter.*

Henry V, Emperor of Germany, the son and successor of Henry IV, was born in 1081, and died at Utrecht in 1125. On his ascension the question of investiture distracted the empire anew. Pope Pascal would only confer the imperial crown upon condition that rights claimed by Gregory should be formally conceded. Henry therefore seized the Pope at the altar, and imprisoned him until he yielded two months later, and crowned Henry in April, 1111. Disturbances, however, arose in Germany, especially with Lothaire of Saxony, and the Pope, declaring that his peace with the emperor had been compulsory, fomented the strife. The war continued two years, and devastated Germany, and after a second expedition to Italy, and excommunication by successive Popes, Henry was compelled to yield in the matter of investiture, and in 1122 subscribed the Concordat of Worms. He was the last of the Salic or Frankish family of emperors, which was succeeded by the Suabian House. He married Matilda, a daughter of Henry I of England.

Henry VI, German Emperor, son of Frederick I and Beatrice of Burgundy, the third emperor of the House of Hohenstaufen, born in 1165, crowned king in 1169, and succeeded his father as emperor in 1190. He kept Richard Cœur de Lion in prison, and obtained a large ransom for him. He died in 1197.

Henry VII, Emperor of Germany, born in 1262, was chosen emperor in 1308. Among the first acts of his reign were recognition of the independence of the Swiss cantons of Schwyz, Uri, and Unterwalden, and the granting of the Kingdom of Bohemia to his son John. He compelled the Milanese to give him the iron crown of Lombardy, suppressed by force the revolt which then broke out in Upper Italy, captured part of Rome, which was in the hands of Neapolitan troops, and was crowned Roman Emperor by two cardinals. He died suddenly in 1313.

Henry II, King of France, born in 1519, succeeded his father, Francis I, in 1547, and died in 1559. Throughout his reign his mistress, Diana of Poitiers, exercised an important influence over king and court. After a brief war with England for the recovery of Boulogne, a war of longer duration and more serious results originated in 1551 in disputes between Henry and the Pope as to the duchies of Parma and Placentia, and continued to devastate Europe till the general peace of Câteau-Cambrésis, 1559. To confirm the peace, Philip II, who was a widower since the death of Mary of England, was to marry Elizabeth, Henry's eldest daughter by Catherine de' Medici. In the course of a tourney held to celebrate the event, Henry was mortally wounded by a splinter from the lance of Lord Montgomery, captain of the Scottish guard. He was succeeded in 1559 by his eldest son, Francis II.—BIBLIOGRAPHY: H. N. Williams, *Henri II, his Court and Times*; H. Lemonnier, *La France sous Henri II* (in Lavisse's *Histoire de France*).

Henry III, King of France, third son of Henry II and Catherine de' Medici, born in 1551, succeeded his brother, Charles IX, in 1574, and died in 1589. In 1573 he was chosen King of Poland, which he was obliged to quit secretly when called to the throne of France. In 1576, after a civil war, he granted to the Protestants the favourable Edict of Beaulieu, but the concession led to the formation of the League, and Henry, to re-establish his authority, declared himself its head. Civil war, however, again broke out, and though hostilities were again put an end to by the Peace of Bergerac in 1577, they were renewed in 1580 until the Peace of Fleix (Nov., 1580). The death of his brother the Duc d'Anjou in 1584, which left Henry of Navarre, a Calvinist, heir-apparent to the throne, brought on another war, called the War of the Three Henrys, the leading persons engaged in it besides the king being Henry of Guise, the real head of the League, and Henry of Navarre. In 1588 Henry of Guise expelled the king from his capital. An apparent reconciliation at Blois was followed by the assassination of the Guises, and Henry, finding himself everywhere opposed by the Catholic party, was compelled to ally himself with Henry of Navarre. The two princes advanced on Paris, but in 1589 Henry III was stabbed by Jacques Clement, a Dominican, and died next day. He was the last of the branch of Orléans-Angoulême of the stock of the Valois, and was succeeded by Henry of Navarre, the first of the House of Bourbon.—Cf. J. H. Mariéjol, *La Réforme et la Ligue* (in Lavisse's *Histoire de France*); Jackson, *The Last of the Valois*.

Henry IV of France was the son of Anthony of Bourbon, Duke of Vendôme, and of Jeanne d'Albret, daughter of Henry, King of Navarre, and herself afterwards Queen of Navarre. He was born in Dec., 1553, at Pau, and died in 1610. Educated by his mother in the Calvinistic faith, he early joined, at her wish, the Protestant army of France, and served under Admiral Coligny. In 1572 he married Margaret of Valois, sister of Charles IX, and after the massacre of St. Bartholomew, which took place during the marriage festivities, was forced to adopt the Catholic creed. In 1576 he escaped from Paris, retracted at Tours his enforced abjuration of Calvinism, put himself at the head of the Huguenots, and took a leading part in all the subsequent religious wars. On becoming presumptive heir to the crown in 1584, he was obliged to resort to arms to assert his claims. In 1587 he defeated the army of the League at Coutras, and after the death of Henry III gained the battles of Arques (1589) and Ivry (1590). He was obliged, however, to raise the siege of Paris; and convinced that a peaceful occupation of the throne was impossible without his professing the Catholic faith, he became nominally a Catholic in 1593. After his formal coronation in 1594 only three provinces held out against him—Burgundy, reduced by the victory of Fontaine-Française in 1595; Picardy, reduced by the capture of Amiens in 1596; and Brittany, which came into his hands by the submission of the Duke of Mercœur in the spring of 1598. The war against Spain was concluded in 1598 by the Peace of Vervins to the advantage of France. The same year was signalized by the granting of the Edict of Nantes, which secured to the Protestants entire religious liberty. He made use of the tranquillity which followed to restore the internal prosperity of his kingdom, and particularly the wasted finances, in which he was successful with the aid of his Prime Minister, Sully. At the instance of Sully Henry divorced Margaret of Valois, and in 1600 married Maria de' Medici, niece of the Grand-Duke of Tuscany, mother of Louis XIII. She was crowned at St. Denis in 1610, but on the following day Henry was stabbed by a fanatic named Ravaillac, while examining the preparations for the queen's entry into Paris. The great benefits which Henry IV bestowed upon France entitle him to the designation which he himself assumed at an assembly of the Notables at Rouen in 1596, the Regenerator of France (*Restaurateur de la France*).—BIBLIOGRAPHY: G. P. R. James, *Life of Henry IV, King of France and Navarre*; A. Poirson, *Histoire du Règne de Henri IV*; C. C. Jackson, *The First of the Bourbons.*

Henry I, King of England, surnamed *Beauclerc* (' fine scholar '), youngest son of William the Conqueror, was born at Selby, in Yorkshire, in 1068, died at Rouen in 1135. He was hunting with William Rufus when that prince was killed, in 1100, and, instantly riding to London, caused himself to be proclaimed king, to the prejudice of his elder brother Robert, then absent as a Crusader. He re-established by charter the laws of Edward the Confessor, recalled Anselm to the primacy, and married Matilda, daughter of Malcolm III of Scotland, thus conciliating in turn the people, the Church, and the Scots. Robert landed an army, but was pacified with a pension, and the promise of succession in event of his brother's decease. Soon after, however, Henry invaded Normandy, took Robert prisoner in 1106, and reduced the duchy. He was successful also in the struggle with France. The last years of his reign were very troubled. In 1120 his only son William was drowned in returning from Normandy, where, three years later, a revolt occurred in favour of Robert's son. The Welsh also were a source of disturbance. Henry appointed as his heir his daughter Matilda or Maud, whom he had married first to the Emperor Henry V, and then to Geoffrey Plantagenet of Anjou. Henry was succeeded by Stephen.—BIBLIOGRAPHY: Sir James Ramsay, *Foundations of England*; E. A. Freeman, *History of the Norman Conquest.*

Henry II, King of England, first of the Plantagenet line, born in Normandy in 1133, died at Chinon in 1189. He was the son of Geoffrey, Count of Anjou, and Matilda, daughter of Henry I. Invested with the Duchy of Normandy, by the consent of his mother, in 1150, he succeeded to Anjou and Maine in 1151, and by a marriage with Eleanor of Guienne gained Guienne and Poitou. In 1152 he invaded England, but a compromise was effected, by which Stephen was to retain the crown, and Henry to succeed at his death, which took place in 1154. The commencement of his reign was marked by the dismissal of the foreign mercenaries; and although involved with his brother Geoffrey, who attempted to seize Anjou and Maine, and in a temporary dispute with France, he reigned prosperously till the contest with Thomas Becket regarding the Constitutions of Clarendon. Although sufficiently submissive after Becket's death in the way of penance and expiation, Henry only gave up the article in the Constitutions of Clarendon which forbade appeals to the court of Rome in ecclesiastical cases. Before this matter was terminated, Henry, in 1171, completed the conquest of Ireland, a great part of which had been reduced by Richard de Clare, Earl of Pembroke, commonly known as Strongbow. Henry's last years were embittered by his sons, to whom he had assigned various territories. The eldest son, Henry, who had been not only declared heir to England, Normandy, Anjou, Maine, and Touraine, but actually crowned in his father's lifetime, was induced by the French monarch to demand of his father the immediate resignation either of the Kingdom of England or of the dukedom of Normandy. Queen Eleanor excited her other sons, Richard and Geoffrey, to make similar claims; Louis and William of Scotland gave them support; and a general invasion of Henry's dominions was begun in 1173 by an attack on the frontiers of Normandy, and an invasion of England by the Scots, attended by considerable disturbance in England. Conciliating the Church by his penance, Henry took prompt action; William of Scotland was captured, and an accommodation arrived at with Henry's sons. These, however, once more became turbulent, and though the deaths of Henry and Geoffrey reduced the number of centres of disturbance, the king was forced to accept humiliating terms from Richard and Philip of France. He ranks among the greatest English kings both in soldiership and state-craft. He partitioned England into four judiciary districts, and appointed itinerant justices to make regular excursions through them; revived trial by jury, discouraged that by combat, and demolished all the newly-erected castles as ' dens of thieves '.—BIBLIOGRAPHY: L. F. Salzmann, *Life of Henry II*; Mrs. J. R. Green, *Henry II*; Sir J. H. Ramsay, *The Angevin Empire.*

Henry III, King of England, son of John by Isabel of Angoulême, born at Winchester in 1207, succeeded his father in 1216, and died in 1272. At the time of his accession the Dauphin of France, Louis, at the head of a foreign army, supported by a faction of English nobles, had assumed the reins of government; but was compelled to quit the country by the Earl of Pembroke, who was guardian of the young king until 1219. As Henry approached to manhood he displayed a character wholly unfit for his station. He discarded his most able minister, Hubert de Burgh, and after 1230, when he received homage in Poitou and Gascony, began to bestow his chief favours upon foreigners. His marriage in 1236 with Eleanor of Provence increased the dislike to him felt by his subjects, and although he received frequent grants of money from Parliament, on condition of confirming the Great Charter, yet his conduct after each ratification was as arbitrary as before. At length the nobles rose in rebellion under Simon de Montfort, Earl of Leicester and husband of the king's sister; and in 1258, at a Parliament held at Oxford, known in history as the Mad Parliament, obliged the king to sign the body of resolutions known as the Provisions of Oxford. A feud arose, however, between Montfort and Gloucester, and Henry recovered some of his power. War again broke out, and Louis was called in as arbitrator, but his award being favourable to the king, Leicester refused to submit to it. A battle was fought near Lewes, in which Henry was taken prisoner. A convention, called *the Mise of Lewes*, provided for the future settlement of the kingdom; and in 1265 the first genuine House of Commons was summoned. Leicester, however, was defeated and slain in the battle of Evesham (1265), and Henry was replaced upon the throne. His son, Edward I, succeeded him.—Cf. K. Norgate, *The Minority of Henry III.*

Henry IV, King of England, first king of the House of Lancaster, born in 1366, and died in 1413. He was the eldest son of John of Gaunt, Duke of Lancaster, fourth son of Edward III, by the daughter of Henry, Duke of Lancaster, great-grandson of Henry III. In the reign of Richard II he was made Earl of Derby and Duke of Hereford, but having in 1398 preferred a charge of treason against Mowbray, Duke of Norfolk, he was banished with his adversary. On the death of John of Gaunt in 1399 Richard withheld Henry's inheritance, and Henry, landing in England, gained possession of Richard's person. The deposition of Richard by Parliament, and the election of Henry, was followed by the murder of the late king. A plot against the king in 1400 was discovered in time to prevent its success, and many executions of men of rank followed; but an insurrection in Wales under Owen Glendower proved more formidable. The Scots were decisively defeated by the Percies at Homildon, and their leader, the Earl of Douglas, was captured (1402). An order from Henry not to permit the ransom of that nobleman and other Scottish prisoners was regarded as an indignity by the Percies, who set Douglas free, made an alliance with him, and joined Glendower. The king met the insurgents at Shrewsbury (1403), the battle ending in the defeat and death of Percy. The Earl of Northumberland was pardoned, and but few victims were executed. A new insurrection, headed by the Earl of Nottingham and Scrope or Scroop, Archbishop of York, broke out in 1405, but was suppressed. The rest of this king's reign was comparatively untroubled. In 1405 James, son and heir to King Robert of Scotland, was captured at sea on his way to France, and was detained a prisoner in England. Henry was succeeded by Henry V.—Cf. J. H. Wylie, *History of England under Henry IV.*

Henry V, King of England, born at Monmouth in 1387, died in August, 1422. On succeeding his father, Henry IV, in 1413, he showed a wisdom in marked contrast to a somewhat reckless youth. He restored their estates to the Percies, and liberated the Earl of March, but in other respects based his internal administration upon that of his father. The persecution of the Lollards is the chief blot upon the early part of his reign. The struggle in France between the factions of the Dukes of Orleans and Burgundy afforded Henry a tempting opportunity for reviving the claims of his predecessors to the French crown. He accordingly landed near Harfleur in Aug., 1415, and though its capture cost him more than half his army, he decided to return to England by way of Calais. A large French army endeavoured to intercept him at the plain of Agincourt, but was completely routed (Oct., 1415). A year later the French were defeated at sea by the Duke of Bedford. In 1417 the liberal grants of the Commons enabled Henry once more to invade Normandy with 25,000 men. The assassination of the Duke of Burgundy, which induced his son and successor to join Henry, greatly added to his power, and the alliance was soon followed by the famous Treaty of Troyes (21st May, 1420), by which Henry engaged to marry the Princess Catherine, and to leave Charles VI in possession of the crown, on condition that it should go to Henry and his heirs at his decease. He returned in triumph to England, but on the defeat of his brother, the Duke of Clarence, in Normandy by the Earl of Buchan, he again set out for France, drove back the army of the dauphin, and entered Paris. A son was at this time born to him, and all his great projects seemed about to be realized, when he died of fever at Vincennes, at the age of thirty-five, and in the tenth year of his reign. He was succeeded by his son, Henry VI.—Cf. C. L. Kingsford, *Henry V, the Typical Mediæval Hero.*

Henry VI, King of England, born at Windsor in 1421, was crowned at Westminster in 1429, at Paris in 1430, and died in 1471. As he was an infant not nine months old at the death of his father Henry V, his uncle John, Duke of Bedford, was appointed Regent of France; and his uncle Humphrey, Duke of Gloucester, made Protector of the Realm of England. A few weeks after Henry's succession Charles VI of France died, when, in accordance with the Treaty of Troyes, Henry was proclaimed King of France. The war which followed at first proved favourable to the English, but in the end, by the heroism of Joan of Arc, the death of the Duke of Bedford, and the defection of the Duke of Burgundy, resulted in the loss to the English of all their possessions in France except Calais. In April, 1445, Henry married Margaret of Anjou, daughter of René of Provence. Two years later Humphrey of Gloucester died, when the Earl of Suffolk acquired the chief power in the kingdom, but his government was very unpopular. The insurrection of Cade followed, and the Duke of York returning from Ireland, a great party was formed in his favour, and he was declared by Parliament Protector of the Kingdom, the imbecile Henry being by this time unable even to personate majesty. The appointment was annulled in the following year, the king having recovered his faculties. York retired to the north, and being joined by his adherents, marched upon London. He encountered and defeated the king's army at St. Albans (1455), the first battle of the thirty years' wars of the Roses. The king again becoming deranged, York was once more made Protector. Four years of peace followed, but the struggle was soon renewed. The king's forces were beaten at Blore Heath and Northampton, and though they gained the battle of Wakefield, at which York was killed, they were again defeated by his son Edward at Towton and Hexham. Henry was restored for a few months in 1471 by Warwick, 'the king-maker', but the battles of Barnet and Tewkesbury proved the hopelessness of his cause, and he died, some say was murdered, a few days after the last battle. He was a gentle, pious, well-intentioned, hopelessly incompetent king, whose principal claim to remembrance is that he founded Eton College and King's College, Cambridge.—Cf. Sir C. W. C. Oman, *Political History of England, 1377–1485.*

Henry VII, King of England, first sovereign of the race of Tudor, born in 1456, died at Richmond in 1509. He was the son of Edmund, Earl of Richmond, son of Owen Tudor and Catherine of France, widow of Henry V. His mother, Margaret, was the only child of John, Duke of Somerset, grandson of John of Gaunt. After the battle of Tewkesbury he was carried by his uncle, the Earl of Pembroke, to Brittany, and on the usurpation of Richard III was naturally turned to as the representative of the House of Lancaster. In 1485 he assembled a small body of troops in Brittany, and, having landed at Milford Haven, defeated Richard at Bosworth, and was proclaimed king on the field of battle, his right being subsequently recognized by Parliament. In 1486 he married Elizabeth, daughter of Edward IV and heiress of the House of York, and thus united the claims of the rival Houses of York and Lancaster. The reign of Henry VII was troubled by repeated insurrections, of which the chief were that headed by Lord Lovel and the Staffords (1486), and the impostures of Lambert Simnel (1487) and Perkin Warbeck (1496–9). He brought about a match between the Infanta Catherine, daughter of Ferdinand of Aragon and of Isabella of Castile, and his eldest son Arthur; and on the death of the latter, in order to retain the dowry of this princess, he caused his remaining son Henry to marry the widow by Papal dispensation, an event which, in the sequel, led to a separation from the See of Rome. He married his eldest daughter to James IV, King of Scotland, from which marriage there ultimately resulted the union of the two crowns. In his latter years his avarice became increasingly marked, two exchequer judges, Empson and Dudley, being employed in all sorts of extortion and chicanery in order to gratify this passion. His reign, however, was in the main beneficent. Its freedom from wars permitted the development of the internal resources of the country. His policy of depressing the feudal nobility, which proportionably exalted the middle ranks, was highly salutary. For a time, however, the power lost by the aristocracy gave an undue preponderance to that of the crown.—Cf. A. F. Pollard, *The Reign of Henry VII.*

Henry VIII, King of England, son of the preceding, born in 1491, succeeded his father in 1509, and died 28th Jan., 1547. He was soon prevailed upon to join in a league formed against Louis XII of France. Some campaigns in France followed, but the success of the English at the Battle of the Spurs (1513) was succeeded by no adequate result, the taking of Tournay being the only fruit of this expensive expedition. Meantime, more splendid success attended the English arms at home, James IV of Scotland being completely defeated and slain at Flodden Field (1513). Henry, however, granted peace to the Queen of Scotland, his sister, and established an influence which rendered his kingdom long secure on that side. Finding himself deluded by his allies, he soon after made peace with France, retaining Tournay and receiving a large sum of money. From 1515 until 1529 the government was practically in the hands of Wolsey, no Parliament being summoned in that period until 1523. After the election of Charles V to the German Empire, both Charles and the French king, Francis I, sought the alliance of England. A friendly meeting took place between Henry and Francis at the Field of the Cloth of Gold (1520), but the interest of Charles preponderated, and Henry declared war against France, though with no important results. Now came the determination of the king to divorce his wife Catherine, who was older than he, had borne him no male heir, and had, moreover, been in the first place the wife of his elder brother. The last of these points was the alleged ground for seeking divorce, though Henry was probably influenced largely by his attachment to Anne Boleyn, one of the queen's maids of honour. Wolsey, for his own ends, had at first been active in promoting the divorce, but drew back and procrastinated when it became apparent that Anne Boleyn would be Catherine's successor. This delay cost Wolsey his power and the papacy its authority in England. Henry in disgust eagerly caught at the advice of Thomas Cranmer, afterwards Archbishop of Canterbury, to refer the case to the Universities, from which he soon got the decision that he desired. In 1533 his marriage with Catherine was declared null and an anticipatory private marriage with Anne Boleyn declared lawful; and as these decisions were not recognized by the Pope, two Acts of Parliament were obtained, one in 1534 setting aside the authority of the chief pontiff in England, the other in 1535 declaring Henry the supreme head of the Church. But although Henry discarded the authority of the Roman Church, he adhered to its theological tenets; and while, on the one hand, he executed Bishop Fisher and Sir Thomas More for refusing the oath of supremacy, he brought many of the reformers to the stake. Finding that the monks and friars in England were the most direct advocates of the Papal authority, and a constant source of disaffection, he suppressed the monasteries by Act of Parliament, and thereby inflicted an incurable wound upon the Catholic religion in England. The fall of Anne Boleyn was, however, unfavourable for a time to the reformers. Henry then married Jane Seymour, and the birth of Prince Edward in 1537 fulfilled his wish for a male heir. The death of the queen was followed in 1540 by Henry's marriage with Anne of Cleves, the negotiations of which were conducted by Cromwell. The king's dislike to his wife, which resulted in another divorce, became extended to the minister who had proposed the union, and Cromwell's disgrace and death soon followed. A marriage with Catherine Howard in 1541 proved no happier, and in 1542 she was executed on a charge of infidelity. In 1543 he married his sixth wife, Catherine Parr, a lady secretly inclined to the Reformation, who survived the king. In the meantime Scotland and France had renewed their alliance, and England became again involved in war. James V ravaged the borders, but was defeated at Solway Moss in 1542, and in 1544 Boulogne was captured, Henry having again allied himself with Charles V. Charles, however, soon withdrew, and Henry maintained the war alone until 1546. Disease now so much aggravated the natural violence of Henry that his oldest friends fell victims to his tyranny. The Duke of Norfolk was committed to the Tower, and his son, the Earl of Surrey, was executed. Henry was succeeded by his son, Edward VI.—BIBLIOGRAPHY: J. S. Brewer, *Reign of Henry VIII*; A. F. Pollard, *Henry VIII*; M. A. S. Hume, *The Wives of Henry VIII and the Parts they played in History*; F. Mumby, *The Youth of Henry VIII.*

Henry of Huntingdon, an English historian, born towards the end of the eleventh century; Archdeacon of Huntingdon. He composed in Latin a general history of England (*Historia Anglorum*, published in the Rolls Series in 1879) from the earliest times down to his own day, the latter part being of considerable value. A letter of his, *De Contemptu Mundi* (On Contempt of the World), contains curious contemporary anecdotes of kings, nobles, and prelates. The time of his death is not known, but he must have been alive in 1154.

Henryson, Robert, a Scottish poet of the fifteenth century, born about 1425, died about 1506. He spent most of his life at Dunfermline, where he was schoolmaster. The *Testament of Cresseid*, his most important work, is a continuation of Chaucer's *Troilus and Creseide.* He was probably the author of the early Scottish pastoral *Robin and Makyne.* Amongst his other works were a *Tale of Orpheus, The Moral Fables of Æsop in Scottish Metre*, and an allegorical ballad, *The Bludy Serk.* The earliest extant edition of his *Fables* is that of 1570, and a new edition by Gregory Smith (Scottish Text Society) appeared in 1906.

Henry the Lion, Duke of Saxony, the most remarkable prince of Germany in the twelfth century, was born in 1129, and died at Brunswick in 1195. He succeeded his father, Henry the Proud, in 1139, assuming the government of Saxony himself in 1146. At the Diet of princes in Frankfort (1147) he demanded restitution of Bavaria, taken from his father by Conrad VII; but was worsted in the war which followed. It was restored to him, however, in 1154, after the death of Conrad, by the Emperor Frederick, Henry's cousin. His possessions then extended from the Baltic and the North Sea to the Adriatic.

and he was successful in opposing the league formed against him at Merseburg in 1166. About two years afterwards he separated from his wife and married Matilda, daughter of Henry II of England. He then went on an expedition to the Holy Land, and during his absence his enemies, and even the emperor, made encroachments on his dominions. In 1174 he followed Frederick I on his fifth expedition to Italy, but left him at the siege of Alessandria. He was then put under the ban of the empire, and his dominions were given to other princes. Henry defended himself for a time successfully, but was at last obliged to take refuge in England. In 1182 he asked pardon of the emperor on his knees, and Frederick promised him his hereditary possessions, Brunswick and Lüneburg, on condition of his undergoing exile for three years. He therefore again went to England, but returned to Brunswick in 1184. In 1188 he was once more compelled to leave the country, and it was only in 1190, at the close of a year's fighting, that a reconciliation was finally effected. He was much in advance of his age in fostering industry, science, commerce, and the arts.

Henry the Navigator (*Don Henrique el Navegador*), fourth son of King John I of Portugal, born in 1394, died at Sagres 13th Nov., 1458. In his youth he gave brilliant proofs of courage. When the Portuguese conquered Ceuta in 1415, Henry distinguished himself by his bravery, and was knighted by his father, after whose death he chose for his residence the city of Sagres, in Algarve, near Cape St. Vincent, and vigorously prosecuted the war against the Moors in Africa. He erected at Sagres an observatory and a school of navigation. From time to time he sent vessels on voyages to the coasts of Barbary and Guinea, resulting in the discovery of the islands of Puerto Santo and Madeira, and some years later of the Azores. In 1433 Gilianez, one of his navigators, safely doubled Cape Bojador, and other adventurers, pushing still farther south, discovered Cape Blanco in 1441 and Cape Verd in 1445. A profitable commerce with the natives of West Africa was soon developed, and the Senegal and Gambia partially explored. In 1458 he acted as general against the Moors. His efforts not only laid the foundations of the commerce and colonial possessions of Portugal, but gave a new direction to navigation and commercial enterprise.—Cf. J. P. Oliveira Martins, *The Golden Age of Prince Henry the Navigator*.

Henty, George Alfred, writer of novels and boys' stories, born 1832, died 1902. He was for a time connected with the army, and was a war correspondent in several campaigns, but is most widely known as the author of a large number of stimulating stories of adventure, many of them based on famous historical events. His stories are not merely readable and exciting, but are designed to interest boys in history. Among his works are: *All but Lost, Gabriel Allen, In the Irish Brigade, With Buller in Natal, Malcolm the Water-Boy, With Roberts to Pretoria, With the British Legion*, and *With Kitchener in the Soudan.*

Hepar Sulphuris (literally 'liver of sulphur', so called from its brownish-green and liver-like appearance), a mixture of polysulphides of potassium with sulphate or thiosulphate of potash. It is a common homœopathic medicine.

Hephæs'tion, a noble Macedonian of Pella, the friend of Alexander the Great. He accompanied the king in his Asiatic campaigns, and died at Ecbatana (325 or 324 B.C.). Alexander had his body conveyed to Babylon, and erected a monument to him costing 10,000 talents.

Hephæs'tus, a god of the ancient Greeks, identified by the Romans with their Vulcanus. He presided over fire, and was the patron of all those who worked in iron and metals. He fixed his residence in Lemnos, where he built himself a palace, and raised forges to work metals. The Cyclopes of Sicily were his workmen and attendants; and with him they fabricated not only the thunderbolts of Zeus, but also arms for the gods and the most celebrated heroes. His forges were supposed to be under Mount Ætna. Aphrodītē (Venus) was the wife of Hephæstus, although according to the *Iliad*, he was married to Charis, one of the Graces.

Hep'tarchy (Gr. *hepta*, seven, and *archē*, rule), a term used during the sixteenth century to designate the period of English history from 449 to 828, and the seven principal kingdoms into which England was divided in Anglo-Saxon times. The kingdoms were founded at different times, and at no one time were they all independent monarchies together. In 827 King Egbert of Wessex united the other kingdoms into one, and assumed the title of King of England. See *England.*

Hera, an ancient Greek goddess, identified by the Romans with their Juno, the sister and wife of Zeus (Jupiter), and daughter of Kronos (Saturn) and Rhea. The poets represent Zeus as an unfaithful husband, and Hera as an obstinate and jealous wife, the result of which was frequent strife between them. She was worshipped in all Greece, but her principal seats were at Argos and at Samos. The companions of Hera were the Nymphs, Graces, and Hours. Iris was her particular servant. Among animals, the peacock, the goose, and the cuckoo were sacred to her. Her usual attribute is a royal diadem on her head. The festivals in her honour were called Heræa. The principal were those celebrated every fifth year at Argos, which city was considered to be especially under her protection.—Cf. L. R. Farnell, *Cults of the Greek States*.

Her'acles, called by the Romans *Hercules*, the most celebrated hero or semi-divine personage of Greek mythology, was the son of Zeus (Jupiter) by Alcmena, the wife of Amphitryon. The name of Hercules is explained as 'renowned through Hera' (*Hera*, and *cleos*, glory). He was brought up at Thebes, and before he had completed his eighth month strangled two snakes sent by the jealous Hera (Juno) to devour him. His tutor was the Centaur Cheiron. Early in life he had, at the command of Zeus, to subject himself for twelve years to the will of Eurystheus, on the understanding that after he had acquitted himself of this duty he should be reckoned in the number of the gods. He therefore went to Mycenæ, and performed at the bidding of Eurystheus the tasks known as the *twelve labours of Heracles*. These were: (1) to kill a lion which ravaged the country near Mycenæ; (2) to destroy the Lernæan hydra; (3) to capture, alive and unhurt, a stag famous for its incredible swiftness, its golden horns, and brazen feet; (4) to capture alive a wild boar which ravaged the neighbourhood of Erymanthus; (5) to clean the stables of Augeas, where 3000 oxen had been confined for many years; (6) to kill the birds which ravaged the country near the Lake Stymphalus, in Arcadia, and ate human flesh; (7) to bring alive into Peloponnesus a prodigious wild bull, which laid waste the Island of Crete; (8) to obtain the mares of Diomedes, which fed upon human flesh; (9) to obtain from the queen of the Amazons a girdle which she had received from Ares (Mars); (10) to kill the monster Geryon, King of Gades, and bring to Argos his numerous flocks, which fed upon human flesh; (11) to obtain apples from the garden of the Hesperides; (12) the last and most dangerous of all, to bring from the infernal regions the three-headed dog Cerberus. Besides these labours, he also achieved of his own accord others equally celebrated. Thus, he assisted the gods in their wars against the giants, and it was through him alone that Zeus obtained the victory. Having attempted to plunder the temple at Delphi, he became engaged in conflict with Apollo, and was punished by being sold to Omphălē, Queen of Lydia, as a slave, who restored him to liberty and married him. On his return to Greece, he became the husband of Deianira, who unwittingly brought about his death by giving him a tunic poisoned with the blood of the Centaur Nessus, which she innocently believed would retain for her Heracles's love. The poison took effect whenever the garment was put on, and as the distemper was incurable, Heracles placed himself on a burning pile on the top of Mount Œta, was received up into heaven, and being there reconciled to Hera, received her daughter Hebe in marriage. In ancient works of art Heracles is generally represented naked, with strong and well-proportioned limbs; he is sometimes covered with the skin of the Nemæan lion, and holds a knotted club in his hand, on which he often leans. The principal ancient statue of him which remains is the Farnese Hercules at Naples, a work of the Athenian Glycon. The myth of Heracles is believed by many writers to represent the course of the sun through the twelve signs of the zodiac. His marriage with Hebe was explained even by the ancients as symbolic of the renewing of the sun's course after its completion.—Bibliography: Ch. Daremberg and E. Saglio, *Dictionnaire des Antiquités Grecques et Romaines*; Gayley, *The Classic Myths in English Literature and in Art*; J. G. Winter, *Myth of Hercules at Rome*.

Heracle'um, a genus of large umbelliferous herbs, the cow-parsnips, of which *H. Sphondylium* (common cow-parsnip or hog-weed) is very common in Britain in damp meadow ground and pastures. *H. giganteum* (the Siberian cow-parsnip) is often grown in shrubberies, reaching the height of 10 feet.

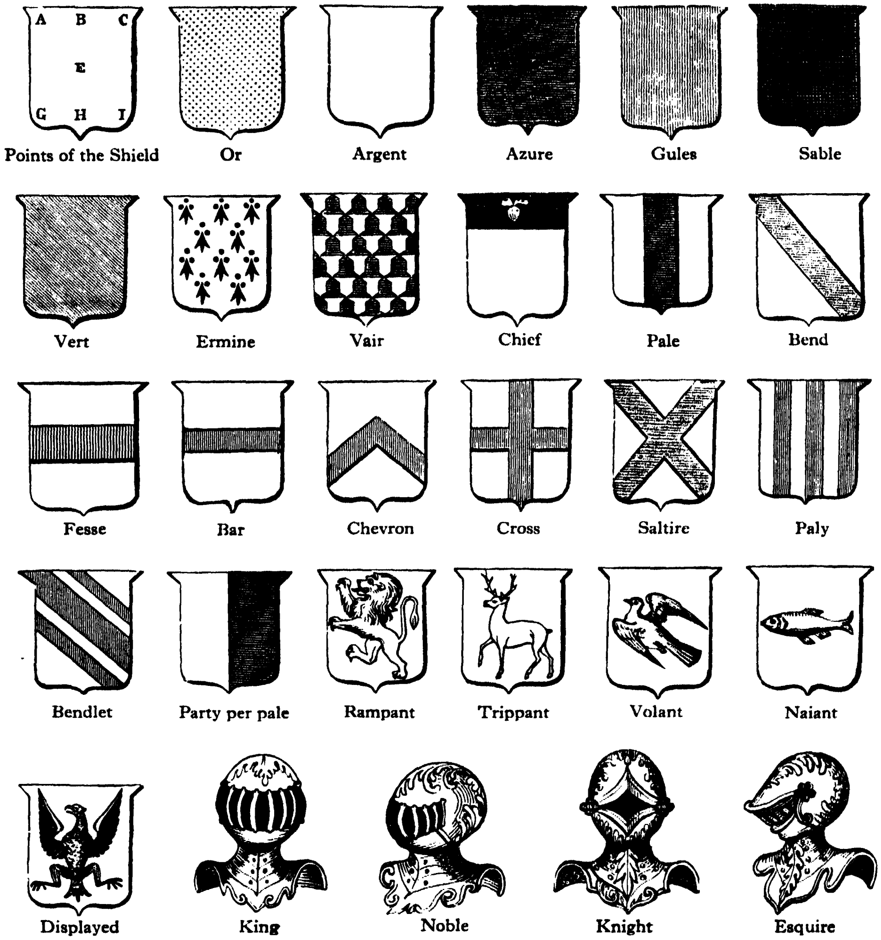
Heracli'dæ, the descendants of Heracles, but more particularly those who, assisted by the Dorians, successfully asserted by arms their claim to the Peloponnesus, whence their ancestors had been driven by usurpers. See *Greece* (*History*).

Heracli'tus, a Greek philosopher, born at Ephesus about 540 B.C. He travelled in different countries, particularly in Africa. On his return to Ephesus he was offered the chief magistracy, but refused it. He is said to have subsequently repaired to solitary mountains to live on roots and herbs; but, being attacked by a fatal disease, was obliged to return to the city, where he died soon afterwards, it is said in his sixtieth year. He left a work *On Nature*, in which he treats also of religion and politics. About 130 genuine fragments of this work remain. He is considered as belonging generally to the Ionic school of philosophers, though he differed from it in important particulars. He considered fire as the first principle of all things, describing it as an ethereal substance, 'self-kindled and self-extinguished', from which the world is evolved (not made) by a natural operation. It is also a rational principle, and the source of the human soul. Phenomena exist in a constant state of flux, always tending to assume new forms, and finally returning again to their source. Heraclitus is the profoundest thinker before Plato and the founder of Idealism. In modern times Hegel and Nietzsche have been influenced by his philosophy.—Cf. T. Gomperz, *Greek Thinkers*.

Heracli'us, Roman emperor of the East, born in Cappadocia about A.D. 575, the son of Heraclius, exarch of Africa. At the head of a fleet from Carthage, in 610, he assisted in dethroning Phocas, the murderer and successor of the Emperor Mauritius, and himself ascended the throne. In a succession of splendid victories he crushed the Persians under Chosroes; but the energy of his earlier years seems to have worn itself out, and he made no effort to check the victorious progress of Mohammed. Before his death Syria, Palestine, Mesopotamia, and Egypt had fallen under the dominion of the caliphs. His last years were devoted to ecclesiastical reforms and theological speculations. Whilst endeavouring to reconcile the Christian sects, his enthusiasm made him oppress his Jewish subjects. He died in 641, and was succeeded by his son, Constantine III.—Cf. J. B. Bury, *The Later Roman Empire.*

Her'ald (O.Fr. *herault, heraut*), an officer whose functions originally were to carry messages of courtesy or defiance between sovereigns or persons of knightly rank, to superintend and register the results of trial by battle, tournaments, and other chivalric exercises, to record the valiant deeds of combatants, proclaim war or peace, marshal processions and public ceremonials, and especially, in later times, to regulate and determine all matters connected with the use of armorial bearings. Heralds began to appear about the twelfth century, and assumed the functions which ultimately belonged to their office gradually. The first use of the word in English documents occurs in 1337. The herald, after the office was fully constituted, was created with many ceremonies, and had to pass through various grades of protracted service before reaching the full dignity of a herald. The office is now shorn of much of its importance. Heralds are appointed in England by the Earl Marshal, whose office is hereditary. The Heralds' College, or College of Arms, founded by charter of Richard III in 1483, consists of the three chief heralds (see *Garter King-of-Arms*), the six subordinate or provincial heralds of York, Lancaster, Chester, Windsor, Richmond, and Somerset; two heralds appointed on the accession of George I, called Hanover herald and Gloucester king-of-arms, together with the Earl Marshal and secretary, in all thirteen persons. There are four marshals or pursuivants, called blue-mantle, rouge-croix, rouge-dragon, and portcullis, who usually succeed to vacancies in the Heralds' College. Among the duties of the Heralds' College are the recording of pedigrees and the granting of coats of arms to persons who wish to assume them. The Heralds' College, or Lyon Court, in Scotland, consists of Lyon king-of-arms, and six heralds. with six pursuivants.

Her'aldry, the whole science of a herald's duties, or more commonly the knowledge of the forms, terms, and laws which pertain to the use of armorial bearings or coats of arms. Badges and emblems on shields, helms, banners, &c., naturally occurred in the earliest times, and the symbols were sometimes hereditary. The origin of heraldic arms, properly so called, is, however, to be attributed to the necessity which arose during the Crusades of distinguishing the leaders of the numerous and motley bands of warriors which constituted the Christian armies. One of the oldest specimens of heraldic bearings extant is the shield at Mans of Geoffrey Plantagenet, who died in 1150. Rolls of arms in England are extant from the reigns of Henry III, Edward I, and Edward II. The use of arms on the Great Seal of England was introduced by Richard I. The bearing of coat-armour by private persons was prohibited by proclamation in the reign of Henry V. The chief courts of jurisdiction in questions of heraldry are the Heralds' College in England, and the Lyon Court in Scotland. (See *Herald.*) The rules of heraldry now practised at the Heralds' College are comparatively modern, and differ in some respects from those of other European courts. A coat of arms consists of the figure of a shield marked and coloured in a vast variety of ways, so as to be distinctive of an individual, a family, or a community. The shield or *escutcheon* represents the original shield used in war, and on which arms were anciently borne. The surface of the escutcheon is termed the *field,* and the several parts or *points* of it have particular names, so that the figures which the field contains may be precisely located. In the accompanying illustration A B C marks the part of the shield called *the chief,* which is the highest and most honourable part of the shield. A is the *dexter chief* or upper *right-hand* side of the shield; B, the *middle chief;* and C, the *sinister chief* or upper *left-hand* side of the shield; E, the *centre* or *fesse point;* G H I, the *base,* that is, G, the *dexter* or right-hand *base;* H, the *middle base;* and I, the *sinister* or left-hand *base.* Colour is given in the coat of arms by means of *tinctures,* two of which are *metals*—*or* and *argent,* that is, gold and silver—the rest *colours* proper. These colours are, in heraldic terminology: *azure,* blue; *gules,* red; *sable,* black; *vert,* green; *purpure,* purple; *tenney,* orange; *sanguine,* blood-colour. The two last are comparatively uncommon. An object represented in its natural colours is said to be *proper.* When not given in colours or by actual gilding, the tinctures are represented by points and lines in black and white. *Or* is distinguished by small dots covering the part; *argent* is represented by leaving the space blank; *azure* is shown by horizontal lines; *gules,* by perpendicular lines; *sable*, by perpendicular and horizontal lines crossing each other; *vert*, by diagonal lines running from the dexter chief to the sinister base; *purpure*, by diagonal lines running from the sinister chief to the dexter base. Another class of tinctures are the *furs*, of which the two principal are *ermine* and *vair*, and which have also their special method of representation. The figures borne on the shield may be either purely artificial and conventional, or may represent real objects, animals, plants, &c. Of the former the most common are known as *ordinaries*, and have the following names: Chief, Pale, Bend, Fesse, Bar, Chevron, Cross, and Saltire. The *chief* is a portion of the shield at the top marked off by a horizontal line, and covers the upper third part of the field. The *pale* occupies the middle third part of the field perpendicularly. The *bend* is drawn diagonally from the dexter chief to the sinister base in the form of a belt, and also occupies the third of the field. A diminutive of the bend is the *bendlet.* The *fesse* occupies the middle third of the field horizontally. The *bar* is formed after the manner of a fesse, but occupies only a fifth of the field, and is not confined to any particular part of it, except when there is only one bar, when it is put in the place of a fesse. Bars are mostly two in a field, sometimes three or more. A diminutive is the *barrulet.* The *chevron* may be regarded as made of a bend dexter and sinister issuing from the right and left base points of the escut-



Points of the Shield
Or
Argent
Azure
Gules
Sable
Vert
Ermine
Vair
Chief
Pale
Bend
Fesse
Bar
Chevron
Cross
Saltire
Paly
Bendlet
Party per pale
Rampant
Trippant
Volant
Naiant
Displayed
King
Noble
Knight
Esquire

HERALDRY

cheon and meeting like two rafters. The *cross* is the ordinary cross of St. George. The *saltire* is the equally well-known cross of St. Andrew. The shield is often divided by lines running similarly to the ordinaries; hence when divided by a perpendicular line it is said to be *party per pale*; when by a horizontal line, *party per fesse*; when by a diagonal line, *party per bend*. Similarly, when it seems to bear several pales or bends or bars, it is said to be *paly*, *bendy*, or *barry* of so many pieces, ' paly of six argent and gules ' for instance, as in illustration. *Charges* are the figures of natural and artificial things, and include animals and plants, implements and objects of all sorts, and various imaginary monsters, being drawn either on the field or on one of the ordinaries. It is a rule in heraldry that metal must not be put on metal nor colour on colour; hence, if the field, say, is *argent*, it cannot have a charge or an ordinary tinctured *or* directly upon it. Various technical terms describe the position of animals; thus, a lion is *rampant* when he is erect standing on one of his hind legs; *sejant*, when sitting; *couchant*, when lying at rest, with the head erect; *passant*, in a walking position; *gardant*, looking full-faced; *rampant gardant*, erect and looking full-faced; *salient*, in a leaping posture. So *trippant* is said of the stag when trotting; *lodged*, of the stag when at rest on the ground; *volant*, of birds in general in a flying posture; *rising*, of a bird that is preparing to fly; *displayed*, of birds seen frontwise with outspread wings; *naiant*, of fishes when swimming; and so on. The teeth and claws of lions and other ravenous beasts are called their *arms*; and when these have a special tincture, the animal is said to be *armed* of such a tincture; similarly, if their tongue be of a special tincture, they are said to be *langued* of this tincture. Often two or more coats of arms are united together on one shield, so that the whole may be a very complicated affair. The art of arranging arms in this way is known as *marshalling*, and when the shield is divided up into squares for the reception of different coats, it is said to be *quartered*. There are also certain exterior ornaments of the shield or escutcheon, namely, the helmet, mantling, crest, wreath, motto, and supporters. The helmet, which is placed on the top of the escutcheon, varies both in form and materials. Those of sovereign princes are of gold, those of the nobility of silver, and those of gentlemen of polished steel. The *full-faced helmet*, with six bars, is for the king and princes of the blood; the *sidelong helmet*, with five bars, is for dukes and marquesses, &c.; the *full-faced helmet of steel*, with its beaver or vizor open, is for knights; and the *sidelong helmet*, with the vizor shut, for the esquire. The mantling or mantle was anciently fixed to the helmet, to which it served as a covering. Mantlings are now used like cloaks, to cover the whole achievement. The crest is placed above the helmet, with the wreath serving as a kind of support; the latter is composed of two colours wreathed or twisted together. The motto consists of the word or phrase carried in a scroll under or above the arms. Supporters were originally only ancient devices or badges, which by custom came to embellish armorial ensigns. They are called *supporters* because they hold the shield, as the lion and the unicorn in the well-known royal arms of England. The present royal arms of Britain exhibit the arms of England, Scotland, and Ireland in the four quarters of the shield; that is: Quarterly, 1 and 4, England; 2, Scotland; 3, Ireland. The arms of England are: Gules, three lions passant gardant in pale or; Scotland, Or, a lion rampant within a double tressure flory counter-flory gules; Ireland, Azure, a harp or, stringed argent.—BIBLIOGRAPHY: J. W. Papworth, *Dictionary of Coats of Arms*; J. Edmonson, *Complete Body of Heraldry*; Woodward and Burnet, *A Treatise on Heraldry, British and Foreign*; P. Allen, *Peeps at Heraldry*; G. C. Rothery, *A. B. C. of Heraldry*; J. H. Stevenson, *Heraldry in Scotland*.

Herat′, a city in the north-west of Afghanistan, in a beautiful and fertile plain, about 370 miles west of Kabul. It is enclosed by a broad deep moat, and an earthen mound surmounted by a lofty wall of unburned brick, and defended by a strong citadel. From each of four of the five gates a long street of bazaars (one vaulted throughout its entire length) leads towards a square in the centre of the town. The remaining streets are narrow and dirty. The most important manufactures are carpets, sword-blades, shoes, cloaks, and sheepskin caps. The trade, almost entirely in the hands of Hindus, is greatly favoured by the situation of the town on the great thoroughfare from India westward. Herat was long the capital of the empire founded by Tamerlane. Pop. about 40,000.

Hérault (ā-rō), a department of France, on the Mediterranean coast; area, 2402 sq. miles. In the north-west it is covered by the Cevennes, but it descends rapidly towards the coast, which is lined by lagoons. The chief rivers, the Hérault, Orb, and Lez, are partly navigable; but the most important water communication is the Canal du Midi. The arable land, about one-sixth of the whole, is generally fertile. The vine and mulberry are extensively, the olive more partially cultivated; fruit is abundant; and aromatic, medicinal, and dye plants are largely grown. Salt is obtained in large quantities. Capital Montpellier. Pop. 488,215.

Herba′ceous Plants, plants of which the stem is not woody, and perishes annually; in herbaceous perennials, the underground parts remain permanent, and send forth a new aerial shoot in the following season.

Herba'rium, or Hortus Siccus, a collection of dried plants systematically arranged. The specimens should be collected in dry weather, and carried home in a japanned tin box or vasculum; a small pocket box being desirable, however, for mosses and small plants; in the tropics a wicker basket is the best receptacle. Very delicate specimens should be at once placed in a small field-book of unsized blotting-paper carried tightly strapped between suitable boards. At home they are carefully arranged upon bibulous paper, and pressed between smoothly-planed deal boards either by putting weights upon the boards or by using a screw-press. The paper is changed every day or two, as the specimens are found to part with their moisture more or less freely. In moist climates it may be necessary to change the papers several times a day. Succulent plants (such as stone-crops) should be killed by immersion in boiling water, and left for some time to drain, before pressing. If the stem be thick and woody, or if the flower be thick and globular, as in the thistle, one half may be cut away without depriving it of its character. When the process of desiccation has been completed, specimens are fastened upon stiff paper (16½ by 10½ inches) with a mixture of gum-tragacanth and gum-arabic, or thin glue, or with slips of gummed paper, or a needle and thread. The finished specimens must be painted with an antiseptic solution such as the following: carbolic acid, 2 oz.; bichloride of mercury, 2 oz.; methylated spirit, 1 gall. As an additional precaution naphthalene should be placed in the cabinet and frequently renewed.—BIBLIOGRAPHY: J. C. Willis, *Flowering Plants and Ferns*; *Kew Bulletin*, 1914.

Herbert, Edward, Lord Herbert of Cherbury, in Shropshire, an English writer, born 1581, and died in London 1648. Educated at University College, Oxford, he distinguished himself at the siege of Juliers under the Prince of Orange in 1609, and in 1614 served again in the Low Countries under the same leader. In 1618 he was sent as Ambassador to the court of France, but was recalled in consequence of a quarrel with Constable Luynes, the favourite of Louis XIII. On the death of Luynes, however, he was sent back to France as resident Ambassador. At Paris, in 1624, he printed his famous book *De Veritate*, with the object of asserting the sufficiency, universality, and perfection of natural religion. In 1625 he returned from France and was created an Irish peer, and in 1631 an English baron. He joined the Parliamentary party, but subsequently quitted it, and suffered in fortune in consequence. The character of Lord Herbert, as shown in his memoirs, was vain, punctilious, and quixotic, but open, generous, and brave. Another work of his was *De Religione Gentilium*. Soon after his death was published his *Life and Reign of Henry VIII*, and a collection of his poems was published in 1665.

Herbert, George, poet and divine, brother of Lord Herbert of Cherbury, born 1593, died in 1633. He was educated at Westminster and at Trinity College, Cambridge, of which he became a Fellow in 1615. From 1619 till 1627 he was university orator. The death of James I in 1625 put an end to his prospects of civil promotion, and in the same year he took orders, and became a prebendary in the diocese of Lincoln. In 1630 he took priest's orders, and was presented to the rectory of Bemerton, near Salisbury, in Wiltshire. His collection of religious poems, *The Temple*, was published in 1631, and the *Jacula Prudentum*, a collection of proverbs, in 1640. His poems bear the marks of an exceptionally fine nature, if not of genius, but they are marred by conceits and mannerisms. His chief prose work was *The Country Parson* (1652).—Cf. A. G. Hyde, *G. Herbert and his Times*.

Herbert, Sidney, Lord Herbert of Lea, English statesman, son of the eleventh Earl of Pembroke, was born in 1810, died in 1861. He was educated at Harrow and Oxford, and was Conservative member for South Wilts from 1832 till shortly before his death. He was Secretary to the Admiralty under Peel in 1841, and in 1845 was made Secretary for War, but became a convert to free-trade, and quitted office with Peel in 1846. In 1852 he became War Secretary in the Aberdeen Cabinet, and retained it till the dissolution of the ministry in 1855. For a short time he was Colonial Secretary under Palmerston, and in 1859 became once more Secretary for War. Early in 1861 he was transferred to the House of Lords, but died in the same year.—Cf. Lord Stanmore, *Sidney Herbert, Lord Herbert of Lea*.

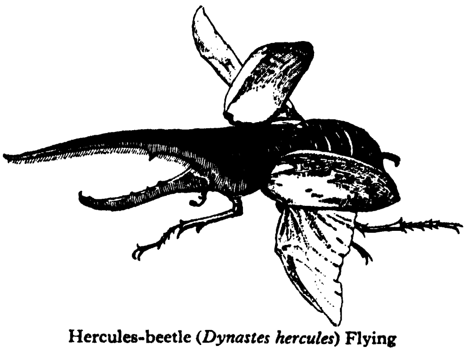
Hercula'neum, an ancient city about 5 miles S.E. of Naples, completely buried, with Pompeii, Stabiæ, &c., by lava and ashes during an eruption of Vesuvius in the reign of Titus, A.D. 79. The modern villages of Resina and Portici are situated on the present surface. The site had been long sought in vain, when in 1713 three statues were found in digging a well at the village of Portici. In 1738 the well was dug deeper, and traces of buildings were found. The theatre was then discovered, but though the excavations were continued for many years it is now the only building to be seen underground, as the successive excavations were immediately filled up with rubbish from a new digging. A number of public buildings and private dwellings were laid bare, and many objects of great value discovered, such as statues, busts, beautiful mosaics, wall paintings, charred papyrus manuscripts, &c. One of the houses discovered contained a quantity of provisions, consisting of fruits, corn, oil, peas, lentils, pies, and hams. It would appear from the human remains found that fewer people escaped from Herculaneum than from Pompeii. Among the most interesting objects discovered here were the papyri, over 1750 of which are now in the Naples Museum. The knowledge of ancient art has, however, gained more by the discoveries made than has literature. Excavations undertaken in 1906 had to be abandoned, owing to the attitude of the Italian Government, and financial difficulties with property-holders in Resina.—Cf. Sir C. Walston and L. Shoobridge, *Herculaneum, Past, Present, and Future.*

Hercules. See *Heracles.*

Hercules, one of Ptolemy's northern constellations, between Lyra and Corona Borealis. The point to which the sun, with its accompanying system of planets, is travelling at present is situated in Hercules. The constellation contains a magnificent globular star cluster.

Hercules, Pillars of, the ancient name of the two promontories, Calpe (Gibraltar) and Abyla (Ceuta), at the entrance to the Mediterranean.

Hercules-beetle, a very large lamellicorn beetle, *Dynastes hercules,* native to tropical America. An enormous horn projects from the head, and a smaller one from the thorax, and the beetle attains a length of 5 inches.



Hercules-beetle (*Dynastes hercules*) Flying

Herder, Johann Gottfried von, German author, born in poor circumstances in 1744, died 1803. In 1762 he went to Königsberg, procured an appointment in Frederick's College, and was permitted by Kant to hear all his lectures gratis. From 1764 to 1769 he was an assistant teacher at the cathedral school of Riga, with which office that of a preacher was connected, and it was during this period that he published his *Fragments on German Literature.* In 1769 he resigned his post in order to travel, and became travelling tutor to the Prince of Holstein-Oldenburg. But in Strasbourg he was prevented from proceeding by a disease of the eyes; and here he became acquainted with Goethe, on whom he had a very decided influence. Besides his *Fragments,* his *Kritische Wälder* (Critical Woods) and other productions had gained him a considerable reputation, and he was appointed in 1771 court preacher, superintendent, and consistorial counsellor at Bückeburg, and in 1776 to the same offices at Weimar. In 1801 he was made president of the high consistory, a place before only given to noblemen. He was subsequently made a noble by the Elector of Bavaria. For some time Herder was interested in the poetry of the North, particularly in the poems of Ossian and the works of Shakespeare. As a result he broke with Classicism, and became one of the leaders of the 'Sturm und Drang' movement. A still greater influence on his mind was his friendship with Hamann, which stimulated his appreciation of poetry and national literature. As a theologian Herder contributed to a better understanding of the historical and antiquarian part of the Old Testament. His *Geist der Hebräischen Poesie* (Spirit of Hebrew Poetry) is highly valued. He did much also for the better appreciation of the classical authors. His greatest work is his *Ideen zur Philosophie der Geschichte der Menschheit* (Ideas on the Philosophy of the History of Man; 1785 *et seq.*). He is the author of some graceful songs, and of an epic entitled *The Cid.*—Bibliography: R. Bürkner, *Herder, sein Leben und Wirken*; H. W. Nevinson, *A Sketch of Herder and his Times.*

Heredit'aments, in law, any species of property that may descend to an heir. *Corporeal* hereditaments consist of material and tangible possessions, lands and houses; *incorporeal* hereditaments of rights and privileges not themselves tangible, though conferring claims on tangible possessions, e.g. easements, reversions, tithes, &c.

Hered'ity, the transmission from parents to offspring of the physical characters and intellectual aptitudes of themselves and their ancestors. Ever since man began to domesticate and breed animals and cultivate plants he has been aware of the general facts of the hereditary transmission of qualities from one generation of living beings to another, even if he had not observed among his fellows the effects of inheritance in their family likenesses. How fully the ancients realized these essential facts is shown in many references to the subject in Greek and Latin literature, and nowhere more clearly than in *The Nature of Things* by Lucretius. But it was not until about forty years ago that the attempt was seriously made to elicit the real meaning of these well-established data by rigid scientific methods. Lucretius called attention to the observation that the offspring may present features distinctive of either the father or the mother or a mixture of the peculiarities of both parents; moreover, he also recognized that a child may reveal traits of its grandparents or even more distant ancestors that were not apparent in its parents. Within recent years the principles underlying these observed facts have been investigated, and the suggested explanations have been submitted to the test of scientific experiment. At the present time no branch of biology is more active than the investigation of these problems, which are still the subject of vigorous controversy, and are exciting a vast amount of attention both in popular and technical journals and books. Many scientific journals are exclusively devoted to the discussion of the problems of heredity, and the mere enumeration of the titles of recent books dealing with the subject would fill many pages of such a volume as this.

In man and all those animals that reproduce their kind by means of the congress of the sexes, a new organism originates by the union of a male cell or spermatozoon with a female cell or ovum. Each of these cells contains a number of exceedingly minute bodies which are known as *chromosomes*, from the fact that they display a special avidity for many of the dyes used in staining sections of the tissues for microscopical examination. The material of which the chromosomes are formed is for the same reason called *chromatin*. When an ovum is fertilized, the paternal chromosomes of the spermatozoon are added to the maternal chromosomes of the ovum, so that the body of the offspring that develops contains a mixture of these minute particles which determine the development of traits of both parental stocks. But before it was recognized how this mosaic of bi-parental characters was conveyed from one generation of living beings to another, the laws regulating the process of admixture had been elucidated by the observations and experiments of the Abbé Mendel, which were published in 1866, but were totally neglected until 1900, when their far-reaching significance was first recognized. Since then a vast amount of experimental breeding of plants and animals has been done by many biologists to confirm and extend the application of the principles laid down by Mendel and to elucidate the mechanism of inheritance. In particular the attempt has been made to bring these results of breeding experiments into correlation with the information independently collected with reference to chromosomes and the part played by them as the bearers of the hereditary qualities. The information relating to these two lines of research will be found in Bateson's *Mendel's Principles of Heredity* and Wilson's *The Cell*; but the reader who merely wants a concise and reliable summary of a very extensive and complex subject will find in Professor Goodrich's *The Evolution of Living Organisms* (1912) a simple and lucid exposition put into a remarkably compact form. Further information of recent progress, brought up to date by the same writer, will be found in *Nature* (24th Nov., 1921, p. 404). The Mendelian laws of inheritance have been determined by crossing allied races of plants and animals which differ one from the other by some character that is easily recognized, and recording what happens (and especially the numerical results) in the succeeding generations. For example, Mendel crossed two races of the common pea (*Pisum sativum*), a tall and a short. The first generation consisted entirely of tall offspring. But on breeding from these one-quarter of the next generation was short and three-quarters tall; and of the latter one-third bred true (i.e. produced exclusively tall offspring), but the other two-thirds a mixture of tall and short in the same proportions as the second generation. In this case tallness is said to be dominant and shortness recessive; and by this is meant that when the embryo is formed by an admixture of long and short factors, the result is determined by the former, which overcomes the influence of the latter. There is no real blending of the effects resulting in a generation intermediate in height between the long and the short; it is an all-or-none effect—either long or short. Recognizing this fact, what happens in the mingling of the long and short elements is expressed in the simple arithmetical statement that by mixing the hereditary factors tall and short, one-quarter of the progeny will be purely tall, one-quarter purely short, and the rest an admixture of tall and short; and as tallness is dominant this half will be tall and, being added to the other quarter, will make three-quarters tall; but as the half that contains the admixture of tall and short elements will segregrate when bred from, they will give rise to three talls to one short. In the interpretation of inheritance these facts suggest the absence of any real blending of characters in the offspring in the sense that a particular feature is intermediate between those of its two parents or two ancestral stocks, but rather that every individual is a mosaic of ancestral units built up into a new pattern, each element of which influences the rest in a manner sensibly different from that of any of its ancestors, and thus gives rise to a personality that is individual and distinctive.

In the process of development of an embryo from a fertilized ovum certain of the cells become specialized in structure and built up into skin, muscle, bone, nerves, glands, &c., of the new being; but some of them retain their primitive characters unaltered and become lodged as guests in the body formed from the other cells. These are the germs of the next generation, the potential ova or spermatozoa from which the children of the hosts of these cells will eventually be formed. Hence the saying that a child is the offspring of its grandparents, seeing that the ovum and spermatozoon from which it was developed were not formed from the tissues of its parents, but merely harboured and protected by them after being formed like the cells of the body itself from the ovum and spermatozoon of a preceding generation. This contrast between body-cells (soma) and germ-cells was emphasized by Weismann, who gave expression to the theory of the continuity of the germ-plasm. By this he claimed that the special protoplasm of the ova and spermatozoa handed on from generation to generation in unbroken sequence, which gave rise to new individuals, was in a sense independent of the soma which, from the point of view of inheritance, was little more than the vehicle of the germ-cells. This was taken to imply that no change in the structure of the body acquired during the life of a parent could be transmitted to the offspring; but it is now recognized that the problem is much more complicated than this crude statement of Weismann's suggests. A great many factors in the animal's environment, as well as in the process of development in its own body, exert a far-reaching influence on the inheritance of characters, and only those traits are brought out and regularly developed which are evoked by the circumstances of the individual's environment and the development of special biochemical stimuli in its own body. The trend of recent research in heredity is to discredit both Weismann's absolute denial of the inheritance of acquired characters and the no less crude interpretation of Lamarck as to the direct influence of environment. Once it is admitted that a special stimulus, either in the environment or in the growth-processes of the individual's own body, is required to call forth the distinctive features of every organism, the way is opened for the recognition of a multitude of factors other than mere continuity of germ-plasm that play a part in moulding the structure of the body and in determining its functional capabilities. During the last thirty years, largely as the effect of Weismann's teaching, an altogether undue importance has been attached to the influence of heredity in the causation of certain disorders of body and mind, such as tuberculosis and insanity, and the effect of this tendency is nowhere revealed more clearly than the reliance put upon such evidence, especially of insanity, in courts of law. It cannot be too strongly emphasized that, far reaching as are the effects of heredity in fashioning the body and determining the mental and moral aptitudes of every individual, environment and individual experience are factors of at least as much importance in the causation of such disorders as have been mentioned. One of the factors in increasing the incidence of tuberculosis or insanity in homes where some member of the family is subject to these affections is environmental: the constant subjection of other members of the family respectively to the risk of infection or to the domestic worries and social anxieties that are caused by an insane or neurasthenic person in the house. The realization of this truth is a factor of tremendous importance in medicine and sociology, for it affords hope for the prevention of these grave ills to the individual, and the social amelioration that follows in the train of such hope and its realization.

During the last quarter of a century a new line of attack on the problems of inheritance has been developed, especially by Professor Karl Pearson and his school of applied statistics at University College, London (see *Eugenics*). By the use of statistical methods the procedures and results of investigators using other methods have been subjected to drastic criticism; but a great deal of constructive work has been done in analysing the data relating to the inheritance of such conditions as albinism and interpreting their significance. Such questions as the hereditary transmission of insanity and the tendency to tuberculosis and the possible effects of alcohol on the descendants of intemperate parents have been made the subject of prolonged research, the results of which have been published in a series of Draper's Company Research Memoirs by the Cambridge University Press, and especially in the journal *Biometrika*. —BIBLIOGRAPHY: E. B. Wilson, *The Cell in Development and Inheritance*; A. Weismann, *The Germ Plasm: a Theory of Heredity*; R. H. Lock, *Variation, Heredity, and Evolution*,

Hereford (he're-ford), a city and municipal borough of England, capital of county of same name, on the left bank of the Wye. The principal streets are broad and straight; houses mostly of brick, and the public buildings of stone. The beautiful cathedral near the Wye was rebuilt, in the reign of William the Conqueror, on the site of an earlier edifice, and restored in 1863 under the direction of Sir G. G. Scott. There is a map of the world made in 1313 (*Mappa Mundi*) preserved in the south choir aisle. Other public buildings are the college adjoining the cathedral, the shire hall, the county jail, free library and museum, corn exchange, market hall, and post office. The manufactures, which are inconsiderable, consist of gloves, leather, turnery, and nails. Hereford was long an important garrison town on the Welsh border, and was the last city to surrender to the Parliamentarians. David Garrick was born at Hereford in 1716. Hereford was a parliamentary borough until 1918, returning two members till 1885, and only one from that date till 1918. Pop. 23,324.

Herefordshire is an inland county which borders on Wales, and has an area of 538,924 acres, of which about 500,000 are arable, meadow, and pasture. The county belongs wholly to the basin of the Severn, towards which river it has a general slope north to south, as indicated by the course of its rivers, the Wye and its affluents. The soil is in general fertile. Wheat is the principal crop, but barley, oats, beans, pease, hops, and turnips are also extensively cultivated. Orchards are numerous, and a large quantity of excellent cider is made. The Herefordshire cattle are held in high estimation for meat, though not good milkers. Horses are bred in considerable numbers. Oak timber is abundant, and forms, with oak-bark, an article of export. For parliamentary purposes Herefordshire forms two divisions, each returning one member. Pop. 113,118.—Cf. *Victoria County History, Herefordshire.*

Heresy (Gr. *hairesis*, choice), a religious opinion declared by ecclesiastical authority to be erroneous. Heretics are those who embrace a heresy, that is, those who hold some theological doctrine which conflicts with the beliefs of the Catholic or Universal Church, but who, at the same time, call themselves Christians. Many of the early Christians preserved their Jewish or Greek philosophical notions, and mingled them with the doctrines of Christianity. Even in the time of the Apostles we find traces of the Gnostics, and subsequently a great variety of heretical sects or sectaries arose. Among the chief may be mentioned the Manichæans, Sabellians, Arians, Apollinarians, Nestorians, Monophysites, Pelagians, Monothelites, Paulicians, &c. Among religionists stigmatized as heretics in later times by the Roman Catholic Church were the Waldenses, the Wycliffites, Hussites, Lutherans, and all Protestant sects and Churches. Before Christianity was made the religion of the Roman State, nothing but excommunication was inflicted upon the heretic; but severe laws were passed soon after the conversion of the emperors. The Code of Justinian contains many ordinances against heretics, and the canon law made it a duty to denounce them, under pain of excommunication. As early as A.D. 385 Priscillian was condemned to death as a heretic by the Spanish bishops at the Council of Trèves; but the persecutions of heretics, properly so called, began in the pontificate of Gregory VII, in the eleventh century. Spain, Italy, and France, from the thirteenth to the sixteenth century, suffered much from these persecutions, but the states of Germany showed greater moderation. In England the burning of heretics was practised before 1200, and long continued. Heresy is now left entirely to the cognizance of the ecclesiastical courts.—BIBLIOGRAPHY: Burton, *Heresies of the Apostolic Age*; A. Harnack, *History of Dogma.*

Herford, a town of Prussia, in Westphalia, 16 miles south-west of Minden. It has manufactures of linen and cotton goods, leather, basket-work, and tobacco, and oil-mills. Once a free city, Herford passed to Prussia in 1815. Pop. 32,500.

Heriot (O.Eng., *here*, army, and *geatu*, equipment), in English law, a tribute or fine, as the best beast or other chattel, payable to the lord of the fee on the decease of the owner, landholder, or vassal.

Her′iot, George, founder of the hospital in Edinburgh which bears his name, and jeweller to King James VI, was born in 1563, and died in 1624. He followed his father's profession, and was admitted a member of the Incorporation of Goldsmiths in 1588. In 1597 he was appointed goldsmith to the queen by James VI, and on the accession of the latter to the English crown followed the court to England. From his settlement in London little is known of his history. He left nearly the whole of his fortune to found a school in Edinburgh, styled in the bequest as a " hospital for the maintenance and education of poor fatherless boys, freemen's sons, of the town ". The present building known as Heriot's Hospital was built between 1628 and 1659, and renovated in 1828. See *Edinburgh.*

Herisau, a town of Switzerland, in the canton and 4 miles north-west of Appenzell. It has manufactures of muslin and other kinds of cotton goods. Pop. 15,502.

Heritable and Movable, in Scots law, a distinction between various kinds of property. Heritable is that which descends to the heir in heritage; movable that which passes to the executor. Under the former term come rights in or connected with land, or all things that go with the land, such as houses, fixed appliances, &c.; under the latter term furniture and other similarly unattached possessions are included.

Heritable Jurisdictions, grants of criminal jurisdiction formerly bestowed on great families by the Scottish Crown, with a view to expediting the administration of justice. Possessors of these jurisdictions could within their domain fine, scourge, imprison, and even in some cases put to death without interference of the common law. They were abolished after the rebellion of 1745.

Her′komer, Sir Hubert von, painter, born in Bavaria 1849, died 1914; lived mostly in England, where he received his art training.

He first exhibited at the Royal Academy in 1869, and gained great reputation by his picture *The Last Muster—Sunday at the Royal Hospital, Chelsea*; and increased his reputation by paintings such as *Eventide: a Scene in Westminster Union*; *Life, Light, and Melody*; *Missing: a Scene at the Portsmouth Dockyard Gate*; *Hard Times*; *Found*; *The Chapel of the Charterhouse*; and *On Strike*. His works include many portraits, among them Wagner, Ruskin, Tennyson, and a large group, *The Council of the Royal Academy*, now in the Tate Gallery. He was elected A.R.A. in 1879, R.A. in 1890, and from 1885 till 1895 was Slade professor of fine art at Oxford. He founded and superintended for a number of years an art school at Bushey, Herts. His work includes water-colours, etchings, and mezzotints, and he published lectures on these subjects. He was knighted in 1907.

Herlies, a village in France, department of Nord, 5 miles north-east of Neuve Chapelle. It was the scene of fierce fighting during the European War (battles of Ypres).

Hermada, a mountain in Italy, south of the Carso plateau, and the scene of fighting between the Austrians and the Italians during the European War (Carso battles).

Her'mann, Johann Gottfried Jakob, a German scholar, born in 1772, died in 1848. He began to lecture on ancient literature at Leipzig in 1794, and with this university he was connected till his death. Hermann originated valuable reforms in the method of Greek grammatical instruction; and he is especially known for his editions of Æschylus, Eúripides, Aristophanes, Bion, and Moschus, and for the controversies in which his theories involved him with Voss, Creuzer, Böckh, Ottfried Müller, and other scholars. Porson's epigram on Hermann, which is based on a couplet of Phocylides, is well known.

Her'mannstadt, a town of Transylvania, now belonging to Roumania, on the Sibiu, 54 miles S.S.E. of Klausenburg. It consists of a high and a low town, connected by steep stone stairs, and of three suburbs. It was strongly fortified up to quite recent times. The manufactures are varied, and there is an important transit trade, chiefly to and from Constantinople. The battle of Hermannstadt, between the Roumanians and Austro-Germans, was fought in Sept. and Oct., 1916. Pop. 25,000.

Hermaph'rodite, a biological term for an animal in which the characteristics of both sexes are either really or apparently combined, especially an animal having the parts of generation both of male and female. Hermaphrodites are divided into true and spurious, the first exhibiting a real combination of the characteristics of the two sexes; while in the second the combination is only apparent. The animals in which the organs of the two sexes are normally combined in the same individual are mostly confined to the invertebrate division of the animal kingdom, as, for example, certain groups of the inferior worms, molluscs, barnacles, &c. There are no real hermaphrodites in the human species.

Hermaphrodī'tus, in Greek mythology, the son of Hermes and Aphrodītē, born on Mount Ida, and brought up by naiads. He rejected the love of the nymph Salmacis, but the latter, embracing him, prayed to the gods to unite her to her lover for ever. The two finally formed a being half male and half female.

Hermas, one of the so-called Apostolic Fathers, generally supposed to be the person mentioned by that name in *Rom.* xvi, 14, though others maintain that he lived much later and was a brother of the Pope Pius I (140–155). He is known as the author of a work entitled *The Shepherd*, circulated at Rome early in the second century, and for which a place in the canon was even claimed. Only a few fragments exist of the Greek original, but the Latin translation, probably made in the second century, and printed in 1513, appears to be complete. The book is an ethical not a theological work, treating of Christian virtues and their exercise.

Hermēs, called by the Romans *Mercurius* (see *Mercury*), in Greek mythology the son of Zeus and Maia, the daughter of Atlas. He was born in Arcadia, and soon after his birth left his cradle and invented the lyre by stringing the shell of a tortoise with three or seven strings. The lyre, however, he resigned to Apollo, with whom it

Hermes. From a bronze statue

was ever after identified. Hermēs also invented the Pandean pipe. The ancients represent Hermēs as the herald and messenger of the gods. He conducted the souls of the departed to the lower world. He was the ideal embodiment of grace, dignity, and persuasiveness, but also of prudence, cunning, fraud, perjury, theft, and robbery. His cunning was frequently of service both to the gods and the heroes, and even to Zeus himself. Later writers ascribe to him the invention of dice, music, geometry, letters, &c. He was worshipped in all the cities of Greece, but Arcadia was the chief place of his worship, his festivals being called *Hermœa*. In the monuments he is represented as in the flower of youth, or in the full power of early manhood. He often appears with small wings attached to his head and to his ankles. Among his symbols are the cock, the tortoise, a purse, &c., and especially his winged rod, the *caduceus.*—Cf. A. Lang, *Myth, Ritual, and Religion.*

Hermes, Georg, a German theologian, born 1775, died in 1831. He studied theology at the University of Münster; became teacher in the gymnasium of that city, and in 1807 professor of dogmatic theology in the university. When the Prussian Government established the University of Bonn, Hermes was appointed to the chair of Catholic theology (1820). Here he distinguished himself by an ingenious effort to base the doctrines of the Church on Kant's system of philosophy. His theological system, known as Hermesianism, was rationalistic in its character, endeavouring as it did to defend the Catholic faith by pure intellectualism. His system aroused powerful opposition, being condemned as heretical by a Papal letter of 1835, four years after the death of its originator. Among his works are: *Untersuchungen über die innere Wahrheit des Christenthums* (1805), and *Einleitung in die Christliche Theologie* (1819–29).

Hermes Trismegis′tus, a mythical personage, the reputed author of a great variety of works, probably written by Egyptian Neo-Platonists, who ascribed the authorship of the highest attainments of the human mind to Thoth, the Egyptian Hermes; regarding him as the source of all knowledge and inventions, the *Logos* incarnate, thrice greatest (Gr. *tris megistos*). Clement of Alexandria mentions the contents of forty-two books of Hermes which were extant in his time. Of those which now remain, the most important is *The Poimandrēs* or *Poimander* (consisting of fourteen or fifteen chapters), a dialogue on nature, the creation, the deity, the soul, knowledge, and similar topics. Of the extant works none belongs, in all probability, to an earlier date than the fourth or perhaps the third century of our era. Like the name of Homer, that of Hermes Trismegistus stands for a whole literature, religious and philosophical. Indeed, during the third and following centuries the name of Hermes was usually adopted by all authors of philosophical writings.—Cf. G. R. S. Mead, *Thrice Greatest Hermes.*

Hermit-crab, a name common to a family (Paguridæ) of well-known decapod crustaceans. These crabs take possession of and occupy the cast-off univalve shells of various molluscs, carrying this habitation about with them, and changing it for a larger one as they increase in size. The most common British species is the *Pagurus Bernhardus*, popularly known as the soldier-crab. Anemones, sponges, and zoophytes are associated with hermit-crabs as messmates.

Hermit-crabs (*Pagurus Bernhardus*)

Hermon, a mountain of Syria, belonging to the Anti-Lebanon, about 9400 feet high. The primitive name was Siryon, and it also occurs in the plural form *Hermonim.*

Hermosillo (-sil′yō), capital of the state of Sonora, Mexico, on the River Sonora, 110 miles north from the port of Guaymas, with which it has a large traffic. It has a mint, distilleries, and flour-mills. Pop. 14,575.

Herne Bay, an English watering-place on the north coast of Kent, 7½ miles north-east of Canterbury, with fine sands, marine parade, iron pier and pavilion, and baths. Pop. (urban district), 11,872.

Hernia, in surgery, a tumour formed by the displacement of a soft part, which protrudes by a natural or accidental opening from the cavity in which it is contained. The brain, the heart, the lungs, and most of the abdominal viscera may become totally or partially displaced, and thus give rise to the formation of hernial tumours. But the term is ordinarily applied to abdominal hernia. Any part of the abdomen may become the seat of hernia, but it most commonly appears in the anterior and inferior region, which, being destitute in a great measure of muscular fibres, and containing the natural openings, offers less resistance to the displacement of the viscera. Most of the viscera, when displaced, push the peritoneum forward before them: this membrane thus forms an envelope of the hernia, which is called the *hernial sac.* The hernia itself is usually a loop of the small bowel, and though it has been pushed through the wall of the abdomen, forming a tumour under the skin, the fæces still pass along it. If the hernia can be returned to the abdomen, it is said to be reducible; if, from its size or other cause, it cannot be replaced, it is irreducible. A hernia is said to be strangulated when it is not only irreducible, but also subjected to a continual constriction, which interferes with the circulation through the blood-vessels of the part and the passage of the fæces. It may be rapidly fatal. Constriction may be produced by different causes, but generally occurs at the margins of the opening through which the hernia protrudes. As soon as a patient perceives that he is affected with a hernia he should have recourse to medical advice, for the disease is then in its most favourable state for treatment. The hernia, when it is reduced, must be prevented from recurring by the constant pressure of a pad or truss. An irreducible hernia must be supported with great care. All violent exercises, and excess in diet, must be avoided. The strangulated hernia requires prompt relief, and may necessitate an operation.

Hernösand (her'neu-sån), a seaport and cathedral town of Sweden, capital of Västernorrland, on the Island of Hernö, in the Gulf of Bothnia, with a considerable shipping trade. Pop. 9785.

Hero, a Greek priestess of Aphrodītē at Sestos, on the coast of Thrace, for love of whom Leander, a youth of Abydos, swam every night across the Hellespont, guided by a torch from her tower. One stormy night the torch was blown out, Leander drowned, and his body washed ashore, when Hero, overcome with anguish, threw herself from the tower on the corpse of her lover, and perished. There is a Greek poem by Musæus on this subject, and the story was beautifully retold by Marlowe, who left it incomplete at his death. Chapman completed it, besides making a more literal translation of the poem of Musæus.

Hero (of Alexandria), one of the most distinguished Greek mathematicians and mechanists of ancient times, who flourished about 150–100 B.C. According to a modern theory, however, he is supposed to have lived during the second half of the first century A.D. A common pneumatic toy, called Hero's fountain, is attributed to him, and he also invented the æolipile, and a heliostat.

Her'od, called *the Great*, King of the Jews, was a native of Ascalon, in Judea, where he was born about 74 B.C. He was the second son of Antipater the Idumean, who, being made Procurator of Judea by Julius Cæsar, appointed Herod to the government of Galilee. He at first embraced the party of Brutus and Cassius, but after their death reconciled himself to Antony, by whose interest he was first named Tetrarch, and afterwards King of Judea. After the battle of Actium he successfully paid court to Augustus, who confirmed him in his kingdom. On all occasions his abilities as a politician and commander were conspicuous; but his passions were fierce and ungovernable, and his wife Mariamne, her brother, grandfather, and mother, and his own sons by her, were all put to death by him. He rebuilt the temple at Jerusalem with great magnificence, and erected a stately theatre and amphitheatre in that city. He also rebuilt Samaria, which he called Sebaste, and constructed many strong fortresses throughout Judea, the principal termed Cæsarea, after the emperor. The birth of Jesus Christ is said to have taken place in the last year of the reign of Herod, viz. 4 B.C., the year also signalized by the massacre of the children of Bethlehem. Herod's policy and influence gave a great temporary splendour to the Jewish nation, but he was also the first to shake the foundation of the Jewish Government, by dissolving the National Council, and appointing the high priests and removing them at pleasure, without regard to the laws of succession.—BIBLIOGRAPHY: W. Willett, *Life and Times of Herod the Great*; J. Vickers, *The History of Herod.*

Herod Agrippa I, son of Aristobulus by Berenice, daughter of Herod the Great. Owing to his attachment to Caligula he was imprisoned by Tiberius, but on the accession of Caligula (A.D. 37) he received the government of part of Palestine, and afterwards all the dominions of Herod the Great. To please the Jews, with whom his rule was very popular, he caused St. James to be put to death, and imprisoned St. Peter. He died in the circumstances related in *Acts*, xii, in A.D. 44.

Herod Agrippa II, son of the preceding, and last of the Herodian line. Being too young to govern, Judea was, on his father's death, reduced to a Roman province. He subsequently received the Kingdom of Chalcis, and obtained the superintendency of the temple at Jerusalem, where, with his sister Berenice, he heard the defence of Paul before Festus. Being driven from Jerusalem by the revolt of the Jews, he joined Cestius, and later on Vespasian, and during the siege of Jerusalem was very serviceable to Titus. After its reduction (A.D. 70) he and Berenice (with whom he was suspected to have an incestuous intercourse) returned to Rome. He is supposed to have died there, A.D. 94.

Herod An'tipas, son of Herod the Great by the Samaritan Malthace, was appointed Tetrarch of Galilee on his father's death (4 B.C.). This was the Herod who put to death St. John the Baptist, in compliment to his wife Herodias and in revenge for his reproaches of their incestuous union. Having visited Rome, he was accused of having been concerned in the conspiracy of Sejanus, was stripped of his dominions, and sent (A.D. 39) with his wife into exile at Lugdunum (Lyons), or, as some say, to Spain, where he died.

Herodas, or **Herondas**, Greek writer of mimes, lived in the third century B.C., probably at Cos. Very little was known about Herodas (even the exact form of his name is uncertain) until 1890, when Sir F. G. Kenyon found at Fayum, in Egypt, a papyrus containing seven mimes in a practically perfect condition, and some fragments. These mimes are written in the old Ionic dialect, though the structure of the sentences is Attic. The metre is the curious *scazon* or limping iambic metre, with a spondee instead of an iambus in the last foot. A mime is a short dialogue in verse describing some scene of actual life. Herodas is an unqualified realist, and gives us much information about the manners and customs of his time. The first mime is a conversation between a matchmaker and a grass-widow, who rejects some of the matchmaker's proposals, but consoles her with a drink of wine. The second is a law-court scene, where a pandar is prosecuting a sailor who has broken into his place of business. It is an immensely clever skit upon the Attic orators, especially Hyperides. The pandar boasts of his family traditions in true rhetorical style: "I am a pandar, and Sisymbras was my grandfather, and Sisymbriskos my father—pandars all". In the third mime a distracted mother gets her incorrigible boy soundly but ineffectually flogged by his schoolmaster. In the fourth two ladies are sacrificing to Asclepios, with an accompaniment of small-talk. In the fifth a jealous woman orders a favourite slave to be flogged, and then countermands the order. The sixth is a conversation, mainly about a new belt, between two women; and the seventh is a scene depicting some customers in a shoemaker's shop. The eighth, which is fragmentary, is about a dream. Herodas is not a great writer, but he is extremely clever and amusing. The mimes are full of delicate touches of humour—humour which is none the worse for being unobtrusive. They bear close study and re-reading. In general tone they are not unlike Mr. F. Anstey's *Voces Populi*.—BIBLIOGRAPHY: editions by Sir F. G. Kenyon and by J. A. Nairn; H. Sharpley, *A Realist of the Ægean*; R. T. Clark, *Theophrastos, Herodas, and Kebes*.

Herod'otus, the oldest Greek historian whose works have come down to us, the 'father of history', born at Halicarnassus, in Asia Minor, about 484 B.C. Before writing his history he travelled extensively, visiting the shores of the Hellespont and the Euxine, Scythia, Syria, Palestine, Babylon and Ecbatana, Egypt as far as Elephantine and other parts of Northern Africa, everywhere investigating the manners, customs, and religion of the people, the history of the country, and the productions of the soil. On returning home he found that Lygdamis had usurped the supreme authority in Halicarnassus, and put to death the noblest citizens, among others his uncle, the epic poet Panyasis, and Herodotus was forced to seek an asylum in the Island of Samos. Having formed a conspiracy with several exiles, he returned to Halicarnassus and drove out the usurper, but the nobles who had acted with him immediately formed an aristocracy more oppressive than the government of the banished tyrant, and Herodotus withdrew to the recently founded colony of Thurii, in Italy, where he seems to have spent most of his remaining life. Here, at an advanced age, we are told by Pliny, he wrote his immortal work, a statement strengthened by the fact that events are noticed in the body of the book which occurred so late as 409 B.C., while its abrupt ending proves almost beyond question that he was prevented by death from completing it. The history is divided into nine books, each bearing the name of a muse, and is written in the Ionic dialect. The object of the historian is to narrate the conflict between the Greeks and Persians, and he traces the enmity of the two races back to mythical times. Rapidly passing over the mythical period, he comes to Crœsus, King of Lydia, of whom and of his kingdom he gives a comparatively full history. The conquest of Lydia by Cyrus induces him to relate the rise of the Persian monarchy and the subjugation of Asia Minor and Babylon. The history of Cambyses and his Egyptian expedition leads him to introduce the valuable details of the history, geography, and manners and customs of Egypt, which occupy the second book. The Scythian expedition of Darius causes the historian to treat of the Scythians and the north of Europe; and the subsequent extension of the Persian kingdom affords him the opportunity for giving an account of Cyrene and Libya. In the meantime the revolt of the Ionians breaks out, which eventually brings on the conflict between Greece and Persia. An account of this outbreak and of the rise of Athens, after the expulsion of the Peisistratidæ, is followed by what properly constitutes the principal part of the work, and the history of the Persian War now runs on in an uninterrupted stream until the taking of Sestos. In his history Herodotus merely relates what he saw and heard. He knows nothing of either historical criticism or the philosophy of history. He never traces the causes underlying political changes, or the ultimate forces behind historical phenomena. There are English translations of his history by Littlebury, Beloe, Cary, G. C. Macaulay, and Rawlinson, the last being accompanied by important notes and dissertations.—Bibliography: W. C. Wright, *A Short History of Greek Literature*; J. B. Bury, *Ancient Greek Historians*; Sir J. P. Mahaffy, *History of Greek Classical Literature.*

Heroes were originally warriors and demigods; certain gods, indeed, were either celestial heroes, like Thor and Indra, the slayers of giants and dragons, or heroes who had been deified or to whose memory had been attached much floating lore about ancient fighting deities. The 'culture-gods' to whom were credited the introduction of new modes of life and new artifacts and a knowledge of the arts and crafts were sometimes 'hero-gods'. Military aristocracies kept alive the memory of a notable leader, and the leader might take the place of the deity whom they had imported. An interesting case in point is Scyld of the Sheaf, who figures in the Old English epic *Beowulf.* Scyld was a Danish chief who gave his name to the Scyldings and was also an ancestor of the West Saxon kings. He was sometimes called 'son of Sceaf (Sheaf)', and sometimes identified with Sceaf, the 'culture-hero'. This Sceaf was a foundling who had come over the sea with his head pillowed on a sheaf of corn and surrounded by implements and weapons. He grew up to be the king of a small nation. Probably he was a memory of Frey, the Scandinavian god, and the deity of the people who had introduced the agricultural mode of life. The memory of Scyld was in time fused with that of Sceaf. Arthur and the Knights of the Round Table were made famous heroes by the romantic poets. Some members of this group were probably real heroes, while others were hero-gods who had been humanized. Sir Kay (Kai) is usually regarded as a fire-god or a Celtic Prometheus who had obtained fire for mankind from the celestial regions. "Very subtle was Kai," we are told in the Welsh romance of *Kulhwch and Olwen.* "When it pleased him, he could render himself as tall as the highest tree in the forest. And he had another peculiarity—so great was the heat of his nature, that, when it raineth hardest, whatever he carried remained dry for a hand-breadth above and a hand-breadth below his hand; and when his companions were coldest, it was to them as fuel with which to light their fire." Lancelot has a fairy foster-mother; he slays a wild boar like the Gaelic Diarmid, and, like Paris, is visited by three supernatural beings, who ask him to decide which of them is the most beautiful. Like Tammuz, who lived for a time in the Underworld as the lover of the Babylonian Persephone, and for a time in the world of men as the lover of Ishtar, Lancelot dwelt a season on 'Joyous Isle' (the Celtic Hades) with Elaine, and on earth loved Queen Guinevere. Many myths and memories collected round the romantic hero. King Arthur probably had a prototype. Prince Arthur, son of King Aidan of the Dalriadic Scots, was in 596 killed fighting against Saxons and Picts, and his memory as a Christian hero may have been fused with legends about the British hero of different name who is called Arthur by Nennius and Geoffrey of Monmouth. The romances added floating traditions and invented much in treating Arthur and his Knights as heroic characters in their narratives, with the result that they represent ideals and have lost their original significance. Brute, the hero who led his Trojans to Britain and founded New Troy (London), was a literary creation of the twelfth century, and in the stories about him may have been preserved a germ of folk-tradition about a hero of another name. Gaelic literature has many heroes. The best known of these is Cuchullin, who has points of resemblance to Achilles. The chief interest in the sagas connected with him, and the group of Red Branch heroes to which he belonged, is the light they throw on the manners, customs, beliefs, and traditions of the Celtic conquerors of Great Britain and Ireland, who used weapons of bronze and iron and fought in chariots like the heroes of Homer. In Britain and on the Continent many folk-heroes do not die but fall asleep. It was believed that they would awake from sleep and return in the hour of their country's need to fight in a great war. Sleeping heroes in Britain include Fionn, Thomas the Rhymer, and King Arthur, and in Ireland Brian Boroimhe. On the Continent the 'sleepers' include Frederick of Barbarossa, William Tell, Charlemagne, &c. More recent heroes who were regarded as 'sleepers' are James IV of Scotland, Napoleon, and the Russian General Skobelev. Some believe the original 'sleepers' were gods. Another view is that the idea that the heroic dead sleep in caves is a survival from early times, when the bodies of heroes were laid in caves and smeared with animating red earth, in the belief that they would revive and come forth after prolonged rest to perform deeds similar to those that had made them famous.

Hérold, Louis Joseph Ferdinand, a French musical composer, born 1791, died 1833. He entered the Conservatoire at Paris, afterwards studied at Rome, and became musical tutor to the daughters of Murat, King of Naples. His first successful opera was *Les Rosières*, produced in 1817. This was followed by, among other minor compositions, *Le Muletier* (1823) and *Marie* (1826). His chief works, however, are the famous *Zampa* (1821) and *Le Pré aux Clercs* (1832).

Heron, the common name of birds of the genus Ardĕa, constituting with the bitterns and shoebills the family Ardeidæ. The herons are very numerous, and almost universally spread over the globe. They are distinguished by having a long bill cleft beneath the eyes, a compressed body, long slender legs naked above the tarsal joint, three toes in front, the two outer united by a membrane, and by moderate wings. The tail is short, rounded, and composed of ten or twelve feathers. The common heron (*Ardĕa cinerĕa*) is about 3 feet in length from the point of the bill to the end of the tail, builds its nest in high trees, many being sometimes on one tree. Its food consists of fish, frogs, molluscs, mice, moles, and similar small animals. It has an insatiable voracity, and digests its food with great rapidity. It haunts freshwater streams, marshes, ponds, and lakes, as also the seashore. It was formerly in high esteem for the table, and, being remarkable for its directly ascending flight, was the special quarry pursued in falconry by the larger hawks. The great heron (*A. herodias*) is an inhabitant of America, and is called also great blue heron; the great white heron or egret (*A.* or *Herodias alba*) belongs to Europe; and the green heron (*A. virescens*), the flesh of which is considered a delicacy, is a native of North America.

Heron (*Ardĕa cinerĕa*)

Herpes is a skin disease and takes the form of an acute eruption of vesicles occurring on the lips, nostrils, or other parts of the face, and in these situations is known as *Herpes simplex.* It also occurs on the genital regions, buttocks, nipples, and mucous surfaces, but is rarely seen in other regions. *Herpes simplex* is frequently seen in pneumonia, cerebro-spinal meningitis, influenza, and catarrhal affections, but on the other hand a person may be affected with recurring attacks on the same part for no obvious cause. *Herpes zoster* (shingles) is an acute infection characterized by an eruption of grouped vesicles occupying a nerve area on one side of the body. There may be considerable general disturbance with fever, and there is much pain and discomfort in the affected region. It is most common on the chest, back, and neck, but may affect any nerve area in the body.

Herre′ra, Francisco de, one of the leading painters of the Seville school, was born there about 1576, died at Madrid 1656. His design and handling are spirited and vigorous, and he may be regarded as to some extent the founder of a new national school. Among his pupils was Velasquez. He painted several pictures for churches in Seville, including an important *Last Judgment*, and four historical pictures for the Archiepiscopal Palace there. His frescoes have mostly disappeared.—His youngest son, Francisco, surnamed *El Mozo*, born 1622, died 1685, studied in Rome, and became court painter to Philip IV. He became Master of the Royal Works under Charles II.

Herrick, Robert, English poet, was born in Aug., 1591, and died in Oct., 1674. His father, a goldsmith in Cheapside, died when Herrick was little more than a year old, and was believed to have purposely thrown himself from an upper window of his house. Herrick was probably educated at Westminster; he was for a time bound apprentice to his rich uncle, also a goldsmith, but in 1613 he entered St. John's College, Cambridge. After being there three years he migrated to Trinity Hall, with the idea of spending less money and of getting better value for what he did spend. He intended to study law, and Trinity Hall then, as now, was famous for its teaching of law. He took his B.A. degree in

1617 and his M.A. in 1620. For some years we lose sight of him; he may have been studying for the Church at Cambridge, or may have been engaged in less reputable pursuits in London. In 1629 he was presented to the living of Dean Prior, a lonely place in Devonshire. He bemoaned his fate in leaving behind the gaieties of the capital, and the society of Ben Jonson, whose literary 'son' he had long been. But he seems soon to have settled down to a quiet and happy life in the country, and it is certainly to his country life that we owe the most exquisite of his poems. He never married, but lived a contented life surrounded by pets of various kinds, and faithfully cared for by his maid Prudence Baldwin. He delighted in the quaint rural customs which he saw all around him, and some of his most charming poems celebrate such things as May Day festivities, harvest home, and Christmas mumming. Herrick was a sturdy Royalist, and accordingly was evicted in 1648 to make way for one Dr. John Syms, a Puritan. In 1648 he published his only volume of poems, entitled *Hesperides, or the Works both Human and Divine of Robert Herrick.* He had the satisfaction of ousting Dr. Syms from Dean Prior in 1662. Little is known of the last twelve years of his life, but he was buried on 15th Oct., 1674. A monument was erected in Dean Prior church in 1857.

There are few poets more charming than Herrick, and few who lend themselves less to critical disquisitions. His work is all self-explanatory, and beautifully lucid. He was an enthusiastic admirer of the Greeks and Romans, and imitated their manner as well as their matter. He frequently imitated Martial, but he is daintier and more spontaneous than the Roman poet. At times he is like the better contributors to the Greek anthology; and some of his work is not unlike that of the pseudo-Anacreon. Some of his poems do not merely remind us of Horace; they place him within a measurable distance of Catullus. Yet Herrick, in spite of many reminiscences of the ancients, is essentially original. Everything that he borrowed he made his own. He was the most celebrated of the 'sons' of Jonson, but he had nothing to learn from his master. Herrick with consummate ease could reach heights to which Jonson's care and toil could never attain. Herrick dances as lightly and gracefully as his own queen of fairies, while Jonson at times is more like an elephant performing at a circus. Herrick's spontaneity, however, is deceptive. Close scrutiny can detect traces of careful workmanship even in those pieces which seem most unpremeditated; and in *His Request to Julia* he begs her commit his poems to the fire should he die before completing them. He was a perfect master of metre, and experimented with many new forms of it, nearly always successfully. In his poems of country life he shows himself a true lover of nature, and though born in Cheapside, as much a Devon man as Blackmore. In his love poems he is charming and dainty, though he never is more than the equal of Horace. His ladies were probably not really loved by him, so that he lacks the poignancy of Catullus. In his fairy poems he shows himself the poet-laureate of the court of Oberon and Titania. In his *Noble Numbers* he shows that he could write songs of good life as well as love-songs. They sustain his reputation as a clergyman more than his reputation as a poet. They help us to understand his strong personality, and are full of manly and practical piety. In personal appearance Herrick was more like a buccaneer than a clerk in holy orders. In his nature he was a curious mixture of pagan and Christian, the pagan element predominating. The essence of his philosophy is to be found in Horace's famous phrase "Carpe diem" or his own "Gather ye rosebuds while ye may". Among all the Cavalier lyrists Herrick reigns as king by the indefeasible right of his daintiness and charm. — BIBLIOGRAPHY: Floris Delattre, *Robert Herrick*; F. W. Moorman, *Robert Herrick: a Biographical and Critical Study*; E. Gosse, *Seventeenth Century Studies.*

Herring, the general name of fishes of the genus Clupĕa, the most important of which is the *Clupĕa harengus*, or common herring. It is of wide distribution in the North Atlantic, 45° N. lat. being about the southern limit. It measures from 10 to 12 inches in length, with blue-green back and brilliant silvery white under parts. It has small teeth in both jaws, and is of an elegant shape, the body being much compressed. It was formerly supposed that the herrings migrated in two great shoals every summer from the Polar Seas to the coasts of Britain and France, returning in the winter, but the migration is probably only from a deeper part of the ocean to a shallower. The feeding-ground of the herring is probably the mud deposits found in the deeper parts of the sea, and it seems to be a fact that during their visits to the shallower waters of the coast for the purpose of spawning they do not feed, or feed very little. They are generally followed by multitudes of hakes, dog-fishes, &c., and gulls and other sea-birds hover over the shoals. They swim near the surface, and are therefore easily taken by net. So great is their fecundity that the enormous number taken appears to produce no diminution of their abundance, as many as 68,000 eggs having been counted in the roe of one female, though this is exceptional. Herrings are taken throughout the year, but in the greatest quantities in summer. There are in fact two races, winter and summer, named from the spawning season. Contrary to the general rule in marine fishes the spawn is heavy, and sticks to various objects on the sea-floor. Winter herring are taken in the Firth of Forth, on the Ballantrae Banks, and off Plymouth. In Scotland the summer or sea-herring fishery is one of the most important industries. The regular fishing begins in May at the Hebrides, in July on the northern coasts, and during August, September, and October along the east coasts of Scotland and England. The mode of fishing most common to Scotland is with the drift-net. A series of nets with meshes about an inch square are joined together on a long rope, the nets being marked by floating corks or bladders, and the united nets are sunk by leaden weights. They thus stand across the path of the fish, which are enmeshed by their gills. Trawling or seine-net fishing is also practised. In Scotland the catch of herrings is generally measured by the 'cran' = 45 gallons; a large proportion are cured or pickled, but great quantities are also disposed of fresh. There are upwards of 7000 boats engaged in the Scottish fishery, with an aggregate of 230,000,000 sq. yards of netting. The annual value of herrings cured in Scotland is usually over £1,000,000. Other prominent members of the herring family (Clupeidæ) are the sprat or garvie (*Clupĕa sprattus*); the pilchard or gypsy herring (*C. pilchardus*), of which the young are the true sardine; the anchovy (*Engraulis enchrasicholus*). Whitebait chiefly consists of the fry of herrings and sprats.

Herrnhut, a village of Saxony, 50 miles E. of Dresden. It was founded by Count Zinzendorf, in 1722, for the Moravian Brethren (q.v.), and it afterwards became the metropolis and centre of that sect of Christians, who, from this town, are often called *Herrnhuters*.

Herschel, Caroline Lucretia, sister of the astronomer Sir William Herschel, born at Hanover 1750, died 1848. She joined her brother at Bath in 1771, and acted during his life as his astronomical assistant. She also found time to conduct a series of observations of her own. In 1828 she received the gold medal of the Royal Astronomical Society, of which she was made an honorary member. On her brother's death she returned to Hanover.

Herschel, Sir John Frederick William, only son of Sir William Herschel, was born in 1792 at Slough, near Windsor, died in 1871. In 1813 he graduated B.A. at Cambridge, and was Senior Wrangler and Smith's Prizeman. After his father's death he spent eight years reviewing the nebulæ and clusters of stars discovered by his father. The results were given in 1833 to the Royal Society in the form of a catalogue of stars. The catalogue contained observations on 525 nebulæ and clusters of stars not noticed by his father, and on a great number of double stars, between 3000 and 4000 in all. In 1830 he produced his excellent *Preliminary Discourse on the Study of Natural Philosophy*, and about the same time published several treatises in the *Encyclopædia Metropolitana*, *Lardner's Cyclopædia*, &c. In 1834 he established, at his own expense, an observatory at Feldhuysen, near Cape Town, his object being to discover whether the distribution of the stars in the southern hemisphere corresponded with the results of his father's labours in the north. He returned to England in 1838, and in 1847 was published *Results of Astronomical Observations made during 1834–38 at the Cape of Good Hope, being the Completion of a Telescopic Survey of the Whole Surface of the Visible Heavens*. He was one of the earliest pioneers in photography; was made a D.C.L. of Oxford; and was created a baronet. In 1848 he was president of the Royal Astronomical Society, and in 1850 was appointed Master of the Mint, an office which he resigned in 1855. Among Sir John's other works are: *Outlines of Astronomy*, *Familiar Lectures on Scientific Subjects*, and a translation of the *Iliad* in verse.—Cf. A. M. Clerke, *The Herschels and Modern Astronomy*.

Herschel, Sir William, astronomer, son of a musician of Hanover, born 1738, died 1822. He came to England in 1757, and was employed in the formation of a military band, and in conducting, while organist at Bath, several concerts and oratorios. Although enthusiastically fond of music, he had for some time devoted his leisure hours to the study of mathematics and astronomy; and being dissatisfied with the only telescopes within his reach, he set about constructing instruments for himself. Late in 1779 he began a regular survey of the heavens, star by star, with a 7-foot reflector, and discovered, 13th March, 1781, a new primary planet, named by him the *Georgium Sidus*, but now known as *Urănus*. This discovery extended his fame throughout the world, and brought him a pension of £400 a year, with the title of Private Astronomer to the King. Assiduously continuing his observations, he measured the rotation of Saturn, discovered two of its satellites, and observed the phenomena of its rings. He also discovered the satellites of Urănus, and observed the volcanic structure of the lunar mountains. At Slough, near Windsor, he erected a telescope of 40 feet length, and completed it in 1787. Herschel received much assistance in making and recording observations from his sister Caroline; and afterwards his brother, a skilful optical-instrument maker, lent him valuable aid. In 1802 he laid before the Royal Society a catalogue of 5000 nebulæ and clusters of stars which he had discovered. He was made D.C.L. by the University of Oxford, and in 1816 was knighted.—Cf. J. L. E. Dreyer, *A Short Account of Sir William Herschel's Life and Works.*

Herse, or **Hearse,** a framework whereon lighted candles were placed at the obsequies of distinguished persons. The funeral herse of the Middle Ages was a temporary canopy covered with wax-lights, and set up in the church; the coffin was placed under the herse during the funeral ceremonies. Sometimes it was a very elaborate structure. The name has been transferred to the modern carriage for bearing a dead body to the grave.

Hersfeld, a town of Prussia, province of Hesse-Nassau, 10 miles N.N.E. of Fulda. Pop. 9612.

Herstal, or **Heristal,** a town of Belgium, on the Meuse, 3 miles north-east of Liége. It was the residence of Pepin le Gros, and afterwards of several French kings of the second race; and has a church founded by Charlemagne. Pop. 22,910.

Hertford, a town and former parliamentary borough of England, capital of the county of same name, on the Lea, 19 miles north of London. It consists of three principal streets, meeting in a central square. There are breweries and oil- and flour-mills. Hertford now gives name to a parliamentary division of the county. The castle, which was built by Edward the Elder about A.D. 905, was occupied by John of Gaunt, and by the queens of Henry IV, V, and VI; and Elizabeth also resided in it occasionally. John II, King of France, and David, King of Scotland, were both in captivity here. Pop. 10,712.

Hertford (contracted **Herts**), English county, is bounded by Cambridgeshire, Essex, Middlesex, Buckingham, and Bedford; area, 404,523 acres, of which about five-sixths are arable, meadow, and pasture. The general aspect of the county is pleasing, being diversified by hill and valley, pasture lands, arable farms, and picturesque parks and woods. The principal rivers are the Lea and Colne, both of which have numerous tributaries. Agriculture employs a large number of the inhabitants; there are manufactures of paper, silk, and straw. For parliamentary purposes it forms five divisions, each returning a member to the House of Commons. Pop. 333,236.

Hertling, Georg Friedrich von, German writer and statesman, born at Darmstadt 31st Aug., 1843, died 4th Jan., 1919. Educated at the Universities of Munich and Berlin and in Italy, he was professor at Bonn and afterwards at Munich. In 1875 he entered the Reichstag, where he became the leader of the Catholic party. During the Kulturkampf, Bismarck employed him to secure concessions from Rome. Bavarian Minister of State in 1891, Hertling became President of the Council and Minister of Foreign Affairs in Bavaria in 1911, but laboured for the supremacy of Prussia. His attitude was appreciated by William II, who appointed him Imperial Chancellor in Nov., 1917, in succession to Michaelis. Although in favour of peace without annexations, Hertling lacked the strength and courage to fight against the Pan-Germanists. He resigned on 30th Sept., 1918.

Hertz, Heinrich Rudolf, German physicist, born at Hamburg 1857, died 1894. He was assistant to Helmholtz, and afterwards professor at Karlsruhe. His work in Dynamics is important, but his great achievement was the discovery of Hertzian Waves (q.v.).

Hertz, Henrik, Danish dramatic poet, was born at Copenhagen, of Jewish parents, 1798, died 1870. He wrote a great number of poems and novels, but his best works are his plays. Among his best known are: *Sparekassen*; *Ninon*; *Svend Dyring's Hus,* a tragedy founded on an old saga; and *King René's Daughter,* which has been translated and performed in France, Germany, and Britain.

Hertzian Waves, ether waves predicted by Clerk Maxwell in 1864 and demonstrated by Hertz in 1888. Using the spark caused by an induction coil in an ‘ oscillator ’, he received and observed the waves by means of a ‘ resonator ’, the latter a simple circuit of wire with a narrow gap across which sparks passed when the circuit was placed in the path of the waves. Hertz showed that these waves could be reflected from metal surfaces, bent out of their course by means of a prism made of pitch, and he found that the waves could pass through stone walls and wooden floors. The waves are propagated through the same medium, and with the same velocity, as light waves, but have a much greater wave-length than the latter. See *Wireless Telegraphy.*—BIBLIOGRAPHY: H. Hertz, *Electric Waves,* translated by D. E. Jones; S. P. Thompson, *Light, Visible and Invisible.*

Her′uli, an ancient Germanic people, originally found on the northern shores of the Black Sea. Under the leadership of Odoacer they helped in the overthrow of the Western Empire. About the end of the sixth century they ceased to have a separate existence as a people.

Hervey Islands, group of islands in the Pacific Ocean, lat. 20° s., long. 160° w., consisting of two coralline islands, annexed to New Zealand (1901), and belonging to the Cook Group. (Area of Cook Group about 280 sq. miles; pop. 12,797). The natives have legends of their migration from Samoa. Pop. 23 (1916).

Herzegovina (hert-se-go-vē′nȧ), a province of the Balkan Peninsula, bounded on the north by Croatia and Bosnia, on the east by Novibazar, on the south-east by Montenegro, and on the south and west by Dalmatia; area, 3560 sq. miles. The surface is generally mountainous, but contains many fertile valleys. Pop. about 200,000. An insurrection which broke out in July, 1875, formed the beginning of a train of events resulting in war between Russia and Turkey. In accordance with the Treaty of Berlin (1878) the province was occupied by Austrian troops, and was ruled by an Austrian military governor until 1918. After the fall of the Austrian Empire Herzegovina became part of Yugo-Slavia (q.v.).

Herzl, Theodor, Jewish politician, founder and leader of political Zionism (q.v.), born at Budapest 2nd May, 1860, died at Edlach, Austria, 3rd July, 1904. Educated in Vienna, where he studied law, he almost exclusively devoted himself to journalism and literature, and to the writing of comedies and dramas. Paris correspondent of the *Neue Freie Presse*, he afterwards became its literary editor. He was in Paris from 1891–5, and moved, no doubt, by the Dreyfus affair, he published his *Judenstaat* (The Jewish State), wherein he advocated the restoration of the Jewish national home as the only remedy against the suffering of the Jews, and the only way of liberating the Jewish nationality as such. Henceforth he devoted his energy and activities to the propaganda of Zionism. In 1897 he founded *Die Welt*, a Zionist organ, and convened the first International Zionist Congress at Basel, of which, as well as of the following six Congresses, he was elected president. Recognized leader of the Zionist movement, he was indefatigable in his efforts, although he encountered only ridicule and hostility among the Jewish opponents of Zionism, and later on had to fight against the intrigues of a faction of Zionists whose ringleaders, envious of Herzl's authority and aspiring themselves to the leadership, did their best to bring about his overthrow. Herzl was received in audience by Kaiser William II, and by the Sultan Abdul Hamid, and in 1901–2 was called to give evidence before the British Royal Commission on Alien Immigration. Abdul Hamid demanded £10,000,000 for a concession in Palestine, but the Jewish millionaires, who could have easily provided the sum, were intransigent in 1903, although the majority of them were to be converted to Zionism less than two decades later. Finding Palestine out of reach for the time being, Herzl therefore negotiated with the British Government and secured the offer of Uganda. The sixth Zionist Congress decided to appoint a Commission to study the fitness of Uganda for colonization, but the minority of the delegates, led by Herzl's personal enemies and political opponents, left the Congress hall in a body. This was a terrible blow to the leader, whose health was already giving way under the strain and stress of his labours. He died of heart failure less than a year afterwards. Besides his *Judenstaat*, Herzl's works include: *Das neue Ghetto*, *Prinzen aus Genieland*, and *Altneuland*. See *Zionism*.

Herzog (hār′zŏ*h*), Johann Jakob, German Protestant theologian, born at Basel 1805, died at Erlangen 1882. He was successively professor of historical theology at Lausanne, church history at Halle, and afterwards at Erlangen. His chief works are: *Calvin and Zwingli*, *Life of Œcolampadius*, and *The Reformation in Basel*; and his great *Real-Encyklopädie für Protestantische Theologie und Kirche*, a vast collection of German learning and speculation, of which he was the editor, and to which he contributed over 500 articles.

He′siod, the father of Greek didactic poetry, lived probably in the eighth century B.C. Little is known of his life beyond what he tells us himself. His father emigrated from Asia Minor to Bœotia, and Hesiod was born at Ascra, near the foot of Mount Helicon. Here he lived the life of a shepherd and farmer. After his father's death the poet is said to have been involved in a lawsuit with his lazy brother Perses, and on losing his case to have migrated to Naupactus. Here he was said to have been murdered by the sons of his host. The poems of Hesiod belong to the Bœotian school of poetry. This school arose partly in opposition to Homer, though the influence of Homer is apparent in all the Hesiodic poems. Homer wrote to please the imagination, Hesiod wrote to instruct. He is strictly utilitarian in all his writings. By far the most important and interesting of them, and the only one which the Bœotians acknowledged as genuine, is the *Works and Days* (Erga kai Hemerai). It is addressed to his brother Perses, and is in the main an exhortation to work. It may be divided into three parts: the first is a glorification of labour: the second contains maxims for farmers; and the third is a sort of calendar, not unlike Ovid's *Fasti*, telling which days are lucky and which unlucky for agricultural employments and for sailing. The poem contains many well-known passages, such as the story of Pandora and her jar, the account of the five ages of the world, the fable of the hawk and the nightingale, and the descriptions of winter and summer. Hesiod lets us see that he was a conservative farmer, an unenterprising stay-at-home man, and a woman-hater.

The Theogony is a much less interesting poem. It is an attempt to systematize mythology, and might be called a sort of Olympian Peerage. It gives an account of the creation, a history of Zeus and Cronos, and a list of women who married gods. Its best passages are those which deal with the war between the gods and Titans. In these passages, and in the lines describing the creation, it is more sublime than the *Works and Days*, but it is not all up to this standard. *The Shield of Heracles* is, in the main, simply a description of that article; it is an imitation of Homer's description of the shield of Achilles (*Iliad*, xviii, 479). It is not a valuable poem.

Hesiod is not a great poet; he rarely attains to anything that could be called sublimity, but he is none the less an interesting and important figure in Greek literary history. He is full of quaint sayings; thus a snail is a " house-carrier ", a burglar is a " day-sleeper ", a serpent " the hairless one ", and to cut one's nails is " to sever the withered from the quick upon that which has five branches ". He takes a naïve and child-like interest in everything that happens in nature, especially when it concerns himself. His chief poem embodies much of the proverbial philosophy of early Greece. Much of it is probably founded upon traditional peasant poetry of Bœotia, maxims simply put into verse for the sake of convenience in remembering, and no more intrinsically poetry than " Thirty days hath September ". From this material it was scarcely possible to make great poetry, but Hesiod has done his best. The *Works and Days* gives us a most valuable picture of life in the village-communities of the eighth century B.C. *The Theogony* preserves some interesting myths, and attempts to throw some light upon the matrimonial affairs of the Olympians. Last, but not least, Hesiod helped to inspire Virgil to write the most finished and delightful of all didactic poems—the *Georgics*.—BIBLIOGRAPHY: translations by A. W. Mair (Oxford Library of Translations) and by H. G. Evelyn-White (Loeb Library); M. Croiset, *Histoire de la Littérature Grecque*; J. Adam, *Religious Teachers of Greece*.

Hesper'ides (-dēz), in Greek mythology, certain nymphs who lived in gardens, of rather uncertain locality, as guardians of the golden apples that grew there, being assisted in the charge by a dragon. Hesiod places the gardens in an island of the ocean far to the west. It was the eleventh labour of Heracles to kill the dragon and bring the golden apples of the Hesperides to Eurystheus.

Hesperor'nis, a fossil bird found in the Cretaceous of Kansas, about 6 feet long, without wings, and having its jaws armed with teeth, which are not set in sockets, but in a common groove. It has been described as " a kind of swimming, loon-like, raptorial ostrich, without fore-limbs, with the gape armed with formidable rows of strong teeth like a gigantic lizard, and with a large, broad, and flattened tail like a beaver ".

Hesse (hes), or **Hessen**, anciently a territory of Germany, situated mainly between the Rivers Neckar, Rhine, Main, Lahn, and Fulda. After various changes it was ruled by the landgrave Philip I, who succeeded in 1509, and at his death in 1567 divided his dominions among his four sons. The death of two of these, however, reunited the territories in part, so that there remained only the two main divisions of Hesse-Cassel and Hesse-Darmstadt, the latter known since 1866 simply as Hesse. See following articles.

Hesse, or **Hessen**, a state of the German Republic, until 1918 a grand-duchy. It was formerly known as *Hesse-Darmstadt*, an independent state of South Germany, consisting of sundry distinct portions. Of the two main portions, one (forming the provinces of Rheinhessen on the left, and Starkenburg on the right bank of the Rhine) lies immediately to the north of Baden; the other, Oberhessen (Upper Hesse), is entirely enclosed by the Prussian province of Hessen-Nassau; area of the whole state, 2968 sq. miles. Oberhessen is generally mountainous; the provinces Starkenburg and Rheinhessen are also mountainous towards their frontiers, more especially in the south-east, but there are also extensive plains belonging to the valleys of the Main and the Rhine. The climate is greatly diversified, being cold and bleak in the mountainous districts, and mild and pleasant in the valleys of the Rhine and the Main. Much of the soil, particularly in the provinces of Starkenburg and Rheinhessen, is remarkably fertile. The vine forms a most important object of culture, and fruit is very abundant. The principal towns are Darmstadt, the capital; Mainz, Giessen, Bingen, and Worms. About two-thirds of the inhabitants are Protestants. Pop. 1,291,249.—The former Grand-Duchy of Hesse originated in the division of the Landgraviate of Hesse in 1567. (See previous article.) In 1806 the Landgraviate was erected into a grand-duchy with an enlarged territory by Napoleon. It was reduced to its present limits in 1866, when it had to cede to Prussia some districts in the north, besides Hesse-Homburg, which, after being separated from it since 1596, had been reunited to it in the beginning of the year in which it was ceded. The grand-duke, Ludwig (Louis, 1837–92), was married to Princess Alice of Great Britain. Hesse was proclaimed a republic in Nov., 1918, and the new Constitution was adopted in Jan., 1919.

Hesse-Cassel, or **Kurhessen** (' Electoral Hessen '), a district of Germany, formerly an independent Electorate, containing 4430 sq. miles, but now, with the exception of several small strips of territory, forming part of the Prussian province of Hesse-Nassau. It was founded in 1567. (See *Hesse*.) The last twenty years of its independent history is simply a narrative of conflicts between the people for political freedom and the Elector for absolute rule. At last, on the outbreak of the German War of 1866, the Elector declared himself on the side of Austria, and his territory was occupied by Prussian troops. On the conclusion of the war Hesse-Cassel was annexed to the Prussian territories.

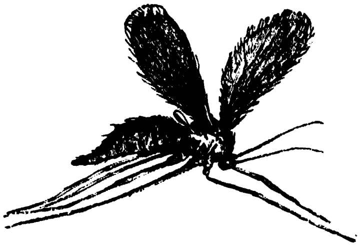
Hesse-Darmstadt. See *Hesse.*

Hesse-Homburg, before its absorption by Prussia after the German War of 1866, a Landgraviate of Germany, consisting of two parts, the lordship of Homburg, situated N.N.W. of Frankfort, and the lordship of Meissenheim. It had an area of about 100 sq. miles, and a population of 27,000 inhabitants. The greater part of the public revenue was obtained from the gaming-tables of the watering-place, Homburg, the capital.

Hesse-Nassau, or **Hessen-Nassau,** a province of Prussia, formed out of the former Principality of Hesse-Cassel, the Duchy of Nassau, the Landgraviate of Hesse-Homburg, the territory and town of Frankfort, &c. It borders on the Prussian provinces of Westphalia, Hanover, Saxony, and the Rhineland, the Republic of Bavaria, &c., and encloses Upper Hesse. (See *Hesse.*) The boundary is partly formed by the Rhine, Main, Weser, and Werra. Other rivers are the Lahn and Fulda. The greater part of this province belongs to the Central German Plateau, and has a rugged surface, partly covered by branches of the Harz. Still, about 40 per cent of the whole is arable, while about the same is under wood. The chief mineral is iron. Mineral springs are numerous. The manufactures consist chiefly of woollens, cottons, and linen. The principal towns are Cassel, the capital, Wiesbaden, and Frankfort. Its area is about 6062 sq. miles, and its pop. 2,273,502 (1919).

Hessian, known in America as *burlap,* is the name of a jute fabric originally made from flax and tow. The standard width is 40 inches. It is used extensively for packing dry-goods and for bag-making, and, when specially prepared, for cheap clothing and stage decoration. In the manufacture of linoleum and the upholstery of furniture large quantities of Hessian are used. The main centres of its manufacture are Dundee and Calcutta; in the former town every variety of the cloth is made.

Hessian Fly (*Cecidomyia destructor*), a fly of the family Tipulidæ, of the ord. Diptera (two-winged flies), the larva of which is very destructive to wheat, barley, and rye crops (it does not attack oats). It is so named from the unfounded belief, prevalent in America, where it is specially destructive, that it was brought over to that country in the baggage of the Hessian mercenaries employed against the Americans in the War of Independence. The female fly is about an eighth of an inch in length, with a wing expanse of about a quarter of an inch. Its body is brown, with the upper parts, the thorax, and the head of a darker shade, approaching to black. The wings are of a dusky grey, and are surrounded by fringes. The male is somewhat smaller than the female and has longer antennæ. The female flies usually lay their eggs on the young plants twice in the year, in May and September, out of which eggs the maggots hatch in from four to fourteen days. These work themselves in between the leaf-sheath and the stem, and fix themselves near the lowest joints, often near the root, and suck the juices of the stem, so that the ear falls down at a sharp angle. These maggots turn to pupæ, from which the flies develop in about ten days. It has long been a pest in America and Germany, but did not appear in Britain till the summer of 1886.



Hessian Fly (*Cecidomyia destructor*)
(magnified)

Heterocer'cal, a term applied to the tails of fishes, when these are externally asymmetrical, the vertebral column running to a point in the upper lobe, as in the sharks and sturgeons, causing this lobe to be much larger than the other.

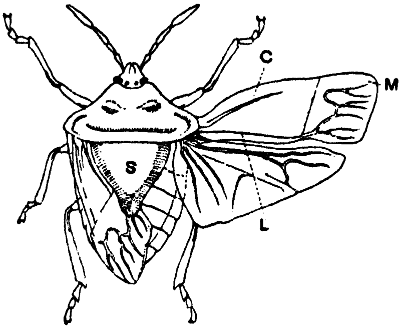
Heterœcious Fungi, those parasitic species which divide their life-history between two hosts; the most familiar example is the wheat-rust, *Puccinia graminis,* which lives alternately on wheat (in summer and autumn) and on barberry (in spring).

Heterog'amous Plants, those in which the male and female gametes differ from one another, sometimes only in size, but more often also in structure. See *Isogamous Plants*; *Oögamous Plants*; *Brown Algæ.*

Heteroousians (het-e-ro-ou'zi-anz), in ecclesiastical history a branch of the Arians who held that the Son was of a different substance from the Father. See *Homoousians.*

Heterop'oda, a group of marine sea-snails, the most highly organized of the Gasteropoda. The foot is compressed into a vertical muscular lamina, serving for a fin, and the gills, when present, are collected into a mass on the hinder part of the back. They swim in an upside-down position. Typical genera are Atlanta (spiral shell), Carinaria (cap-shaped shell), and Pterotrachæa (no shell).

Heterop′tera (Gr. *hetĕros*, different, and *pteron*, a wing), a section of hemipterous insects comprising those in which the two pairs of wings are of different consistence, the anterior pair being horny or leathery, but generally tipped with membrane. They comprise the land and water bugs. By some naturalists the Heteroptera are separated from the Homoptera (the other section of the Hemiptera), and raised into a distinct order.



Heteroptera. *Pentatoma Dissimile*

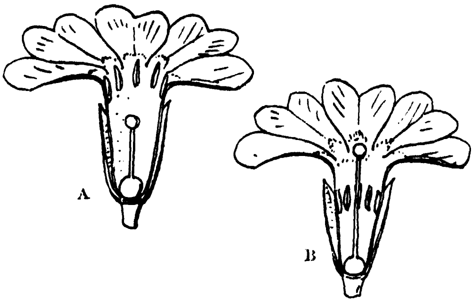
C, Corium. L, Clavus. M, Membrane. S, Scutellum.

Heteros′pory, the condition of such plants as Selaginella, in which the sporophyte bears two kinds of spores, viz. small *microspores*, produced in large numbers in *microsporangia*, and giving rise to purely male gametophytes, and larger *megaspores*, produced in small numbers (typically four in Selaginella) in *megasporangia*, and giving rise to purely female gametophytes. In Selaginella the two types of sporangia are indistinguishable up to a fairly advanced stage of growth; after that, all the spore mother-cells of a microsporangium develop equally, and give rise to microspores; in the megasporangium, on the other hand, one spore mother-cell develops at the expense of all the rest, which are digested and absorbed by it. In this case, therefore, the heterosporous condition is partly a matter of nutrition, but its actual origin is obscure. Heterospory is an ancient development, being found in living or extinct members of all the great groups of Pteridophyta. The seed-habit found in all Angiosperms and Gymnosperms, as well as in the extinct Pteridosperms, and in a partial form in some fossil Lycopods, is a secondary consequence of heterospory, which, therefore, ranks as one of the most important evolutionary advances made by land-living plants.

Heterotro′phic Plants, those which depend entirely on organic food-materials, i.e. on food obtained at second-hand; they may be *saprophytes* feeding on dead organic material, or *parasites* nourishing themselves at the expense of a living host. Opposed to Prototrophic Plants.

Hetman, or **Ataman**, the title of the head (general) of the Cossacks. This dignity was abolished among the Cossacks of the Ukraine by Catherine the Great. Until the Russian revolution of 1917 the title of chief hetman was held by the Russian heir apparent to the crown. See *Cossacks*.

Hetrosty′ly, or **Heterosty′lism**, in flowers, a condition seen in its typical form in the primrose and other species of Primula. Two kinds of flowers are found, each on a separate plant, distinguished by the relative lengths of stamens and styles. One type, the 'long-styled' or 'pin-eyed', has a style reaching to the eye of the flower, with the anthers half-way down the tube of the corolla; in the 'short-styled' or 'thrum-eyed' type the anthers are in the eye of the flower, whereas the style extends only half-way up the tube. In other words, the stigma of the long-styled flower is at the same level as the anthers of the short-styled flower, and vice versa. Evidently the pollinating insect-visitors will tend to bring about cross-pollination between flowers of opposite types, and, as Darwin has shown, it is precisely this 'legitimate' pollination which results in a full yield of fertile seed. Heterostylism is thus one of the devices favouring cross-pollination. Similar dimorphism of flowers occurs in many other plants, such as water-violet, bog-bean, sea-lavender, and buckwheat; purple loosestrife has trimorphic flowers (long-, short-, and medium-styled), and Epigæa tetramorphic flowers.—Cf. C. Darwin, *Forms of Flowers*.



Hetrostyly, or Heterostylism, in the Primrose

A, Short-styled or thrum-eyed. B, Long-styled or pin-eyed.

Heuchera, a genus of perennial herbs, ord. Saxifragaceæ, natives of North America and Siberia. Several species, with panicles of pink or white flowers rising from a rosette of graceful lobed and toothed leaves, are favourites of the rock-garden and herbaceous border.

Heudicourt, French village, department of Somme. It was the scene of fighting during the European War, and was captured by the British in April, 1917, and again in Aug., 1918.

Hevea, a genus of tropical American trees, ord. Euphorbiaceæ. Para rubber is obtained from *H. elastica*, *H. brasiliensis*, and other species. See *Rubber*.

Hexam'eter (Gr. *hex*, six, and *metron*, measure), a verse of six feet, the heroic or epic measure of the Greeks and Romans. The sixth foot is always a spondee (two long syllables) or a trochee (a long and a short). The first five may be all dactyls (one long syllable and two short), or all spondees, or a mixture of both. The scheme of this verse then is:

—⏑⏑ | —⏑⏑ | —⏑⏑ | —⏑⏑ | —⏑⏑ | —⏓
or, —— | —— | —— | —— | —— | ——

with all the varieties which the mingling of the two kinds of feet affords. In modern poetry the hexameter has been frequently used. In English hexameters accent is almost entirely substituted for quantity, and trochees generally take the place of spondees. Longfellow in his *Evangeline*, Kingsley in his *Andromeda*, and Clough in his *Bothie* have adopted this form of verse. The following lines are specimens of Clough's English hexameters:

O let us | try, he | answered, the | waters them | selves will sup | port us, |
Yea very | ripples and | waves will | form to a | boat under | neath us.

The hexameter is not well suited to the genius of the English language; the least unsuccessful English hexameters are valuable in spite of their metre rather than because of it.

Hex'apla (Gr. *hexapla*, 'six-fold'), a collection of the Holy Scriptures in six languages; applied particularly to the combination of six versions published by Origen, containing the Hebrew text with a transcript of it in Greek characters, the *Septuagint*, and three other versions, those, namely, of Aquila, Symmachus, and Theodotion. It is only extant in fragments.

Hexham, a town of England, in Northumberlandshire, on the Tyne, about 20 miles west of Newcastle. There are here ruins of an abbey church, originally a cruciform structure, built about A.D. 674, destroyed two centuries later by the Danes, renovated in 1118, and demolished by the Scots in 1296. Hats, gloves, and leather are manufactured, but the industries are chiefly agricultural. Hexham gives name to a parliamentary division of the county. Pop. 8849.—The Battle of Hexham, fought 15th May, 1464, was one of those belonging to the Wars of the Roses. The Lancastrians under Somerset were defeated by Montague, the former being slain.

Heylin, Peter, English theologian, born 1600, died 1662. He published his *Microcosmos, or Description of the Globe*, in 1625. In 1629 he became chaplain to Charles I, and obtained several benefices, from which he was ejected during the Civil War. At the Restoration he was made sub-dean of Westminster. He wrote a *Life of Laud*, a *Defence of the Church of England*, and several theological works.

Heyne (hī'nė), Christian Gottlob, German scholar, born 1729, died 1812. He was educated at Chemnitz and at Leipzig University, and after a long struggle with poverty he received, in 1763, an invitation to become professor of rhetoric and poetry at Göttingen. He was soon after (1764) appointed first librarian, and remained there till his death. He particularly applied himself to classical criticism and the illustration of the writings of the ancients, and published valuable editions of Homer, Pindar, Diodorus Siculus, Epictetus, Virgil, and Tibullus, all with full commentaries.

Heyse (hī'zė), Paul Johann Ludwig, German novelist and dramatist, born at Berlin 1830, and died in 1914. He wrote many plays, and short stories for newspapers and magazines; but his fame rests on his great novels *Die Kinder der Welt* (The Children of the World), 1872, and *Im Paradiese* (The Paradise Club), 1875, and his tale entitled *L'Arrabbiata* (1853), generally recognized as among the most powerful and artistic works of modern German fiction. Heyse was awarded the Nobel Prize for literature in 1911.

Heywood, John, an early English dramatist, born in the end of the fifteenth century, died at Mechlin sometime about 1580. Sir Thomas More introduced him at the court of Henry VIII, with whom he became a favourite. His zealous attachment to the Roman Church recommended him to Queen Mary; but this very circumstance rendered him an object of suspicion during the two succeeding reigns, and he found it expedient to retire to the Continent. Heywood's dramatic works are known as *Interludes*, and they stand between the miracle-plays and the drama proper. Among them are: *A mery Play between the Pardoner and the Frere, the Curate and Neybour Pratte*; *The Play of Love*; *The Four P's*; &c. He also wrote epigrams and ballads.

Heywood, Thomas, dramatist, lived in the reigns of Elizabeth, James I, and Charles I. He was born in Lincolnshire, and educated at Cambridge. He composed wholly or in part 220 different plays. Of these only about twenty-four remain, of which the one most admired is *A Woman Killed with Kindness*, published in *Dodsley's Collection*. He was also the author of

Great Britain's Troy, *An Apology for Actors*, and a number of other works.—Cf. A. W. Verity (editor), *The Best Plays of Thomas Heywood.*

Heywood, a municipal borough of England, in Lancashire, about 8 miles north-west of Manchester. The making of power-looms, iron- and brass-founding, boiler-making, and all branches of cotton-spinning and manufacturing, with other industries, are extensively carried on. Heywood and Radcliffe give name to one of the parliamentary divisions of the county. Pop. 26,691.

Hezeki'ah (*Hizkiyah*, generally *Hizkiyahu*, strength of Jehovah), the twelfth, and one of the best of the Kings of Judah. He succeeded Ahaz about 717 B.C., and died about 698 B.C. He repressed idolatry, fought successfully against the Philistines, and hoped to become entirely independent of Assyria, but had his fenced cities captured, and was mulcted in a large tribute. About this time Hezekiah had a serious illness from which he miraculously recovered, and celebrated his fresh lease of life in a thanksgiving, preserved in *Is.* xxxviii. Among the ambassadors who came with letters and gifts to congratulate him on his recovery was the Viceroy of Babylon, to whom he displayed the royal treasures. For this he received a terrible rebuke, and he was told by Isaiah that from Babylon would come the ruin and captivity of Judah. The greater part of the Scripture records bearing on the reign of Hezekiah is occupied by the two invasions of Sennacherib, and the sudden destruction of the Assyrian army. Hezekiah did not long survive this deliverance.

Hibbert Lectures, a course of lectures founded by Robert Hibbert, in 1847, for the promotion of comprehensive learning and thorough research in relation to religion wholly apart from the interest of any particular Church or system. The first course was given at Westminster in 1878 by Professor Max Müller, *On the Origin and Growth of Religion, as illustrated by the Religions of India.* Subsequent lecturers have been M. Renouf, M. Ernest Renan, Rhys Davids, Kuenen, Pfleiderer, Sayce, Montefiore, Drummond, and Farnell.

Hibernation. See *Dormant State.*

Hibis'cus, an extensive genus of plants, nat. ord. Malvaceæ (mallows), chiefly natives of tropical climates. They have large showy flowers, borne singly upon stalks towards the ends of the branches, these flowers having an outer calyx (called the epicalyx) of numerous leaves in addition to the true five-lobed persistent calyx. They are chiefly shrubs, one or two being herbs, and a few attaining the dimension of trees. The species are remarkable for abounding in mucilage and for the tenacity of the fibre of their bark, whence several are employed for many economical purposes in the different countries where they are indigenous. The petals of *H. rosa-sinensis*, a plant with large, handsome, usually red flowers, frequent in greenhouses, are astringent, and used in China as a black dye for the hair and eyes. The handsome flowering shrub known in gardens as *Althæa frutex* is a species of hibiscus (*H. syriacus*). The root of *H. Manihot* yields a mucilage used in Japan as size and to give a proper consistence to paper. The leaves of *H. cannabinus* are eatable, and an oil is extracted from its seeds, while it is cultivated in India for its fibre, and hence known as Indian hemp.

Hiccup, or **Hiccough**, is a convulsive catch of the respiratory muscles, with sonorous inspiration, repeated at short intervals. Though generally a trivial and transient inconvenience, its occurrence in the last stages of acute disease is a grave, and often a fatal symptom. The frequent swallowing of small pieces of ice, or small doses of anti-spasmodic medicines, usually relieves a severe fit.

Hickes, George, English divine, philologist, and antiquary, was born 1642, died 1715. He became Dean of Worcester in 1683, but he was deprived of his deanery in 1690 for refusing to take the oaths to William III after the Revolution. He followed the fortunes of James II, and was consecrated Suffragan Bishop of Thetford in 1694 by the non-juring Archbishop Sancroft. Of his numerous works the most important are: *Institutiones Grammaticæ Anglo-Saxonicæ et Mœso-Gothicæ*, &c. (Oxon, 1689), and *Linguarum veterum septentrionalium Thesaurus Grammatico-Criticus et Archæologicus* (Oxon, 1705).

Hick'ory, the name given to several species of timber trees of the genus Carya, belonging to the nat. ord. Juglandaceæ (walnut). They are natives of North America, and are remarkable for stateliness and general beauty. The wood is heavy, strong, and tenacious, and is used for making carriage-shafts, screws, whip-handles, cogged wheels, &c. The shag-bark (*C. alba*) yields the hickory-nut of commerce, and its wood is very valuable. *C. olivæformis* yields the pecan-nut. The pig-nut or brown hickory is the *C. glabra*, and the swamp hickory is *C. amara*, so called from the bitterness of its nut.

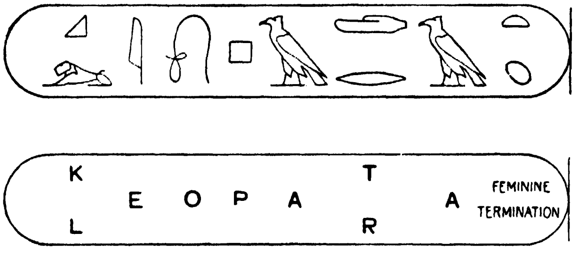
Hidalgo, a Spanish nobleman of the lower class. There were *hidalgos de naturaleza*, of noble birth, and *hidalgos de privilegio*, that is, those on whom the king had conferred nobility, and those who purchased nobility. The title is now obsolete.

Hierap'olis, a ruined city of Asia Minor, near the right bank of the Lycus, 121 miles east by south of Smyrna. It was famous for its thermal springs, was the birth-place of Epictetus, and is mentioned by St. Paul in his *Epistle to the Colossians* (iv, 13).—Another *Hierapolis*, called Bambyce, is in Syria.

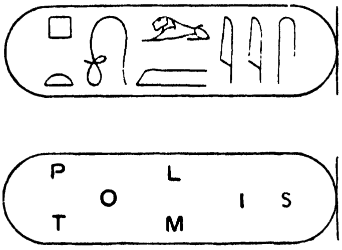
Hi′erarchy (from Gr. *hieros*, sacred, and *archē*, government), sacred government, sometimes the Church, sometimes the rule which the ecclesiastical governing body exercised as at once priests and civil magistrates. In the former sense the hierarchy arose with the establishment of the Christian Church as an independent society. In the Middle Ages the Papal hierarchy gathered great strength, and the Pope became a spiritual monarch, ruling western Christendom with power but feebly limited by princes and councils. A reactionary movement began in the fourteenth century, and the general tendency of subsequent events has always been to make the civil and hierarchical power more and more independent of each other. The term *hierarchy* as used to denote the governing and ministering body in the Church, according to its several gradations, can strictly be applied only to those Churches which are ruled by bishops, such as the Roman Catholic Church and the Anglican Church, which also holds the theory of a hierarchical gradation of rank and authority. Both these Churches acknowledge the three orders of bishops, priests, and deacons.

Hi′ero I, ancient Greek ruler or ‘Tyrant’ (that is, absolute monarch) of Syracuse, in Sicily, brother of Gelon, whom he succeeded in 478 B.C. He was an enlightened ruler, and a patron of genius and learning. His court became the rendezvous of the most distinguished writers of his time, including Pindar, Æschylus, Bacchylides, Epicharmus, and Simonides. The *Hiero* of Xenophon contains the finest eulogium of this monarch. He was several times victor in the Grecian games. Pindar has celebrated his victories: several odes of this poet are filled with his praises. Hiero died at Catana, 467 B.C.

Hiero II, King or Tyrant of Syracuse (269–214 B.C.), son of Hierocles, a noble Syracusan, who claimed a descent from the family of Gelon. He was chosen by the soldiers as general in 275 B.C, and recognized as king about 270. In 264 he made an alliance with the Carthaginians against Rome, and thus began the first Punic War. Being defeated by the Romans, he made peace by the payment of tribute, and was ever after a faithful and useful ally to them. His subjects enjoyed great prosperity during his reign. Hiero devoted himself to the construction of military machines of all kinds, and ships of great size, under the direction of Archimedes, who lived in Syracuse during this reign.



Cartouche of Kleopatra

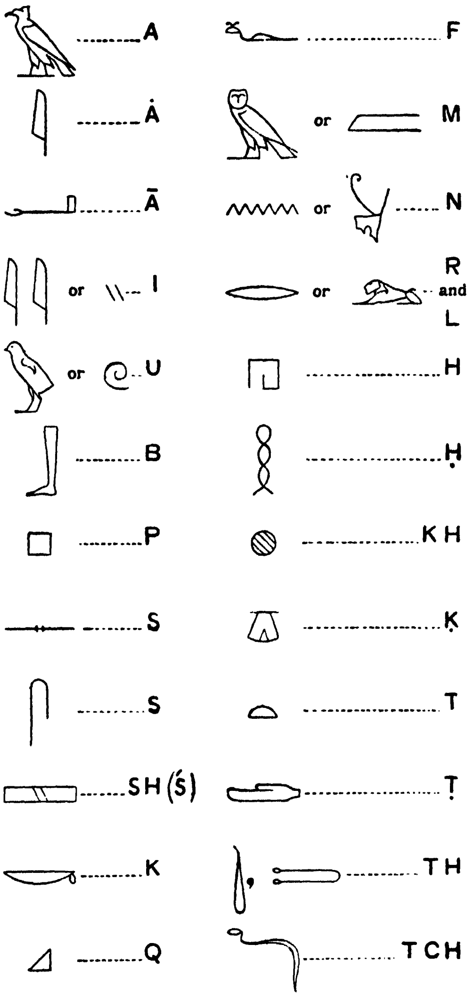


Cartouche of Ptolemaios, i.e. Ptolemy

Hieroglyph′ics (from Gr. *hieros*, sacred, and *glypho*, I engrave), a term originally applied to the inscriptions sculptured on buildings in Egypt, in the belief that the writing was confined to sacred subjects, and legible only to the priests. The term has also been applied to picture-writing in general, such as that of the Hittites and of the Mexicans and the still ruder pictures of the North American Indians. Three different modes of writing were used by the ancient Egyptians, the *Hieroglyphic*, the *Hieratic*, and the *Demotic*. Pure hieroglyphic writing is the earliest, and consists of figures of natural objects from every sphere of nature and art, with certain mathematical and arbitrary symbols. Next was developed the hieratic or priestly writing, the form in which most Egyptian literature is written, and in which the symbols almost cease to be recognizable as figures of objects. Hieratic writings of the third millennium B.C. are extant. In the demotic or *enchorial* writing, a very cursive form (the ancient ‘running hand’), derived directly from the hieratic, the symbols are still more obscured. The demotic was first used in the ninth century B.C., and was chiefly employed in social and commercial intercourse. Down to the end of the eighteenth century scholars failed to find a clue to the hieroglyphic writings. In 1799, however, M. Bouchard, a French captain of engineers, discovered at Rosetta the celebrated stone which afforded European scholars a key to the language and writing of the ancient Egyptians. It contained a trilingual inscription in hieroglyphics, demotic characters, and Greek, which turned out to be a decree of the priests in honour of Ptolemy V, issued in 195 B.C. The last paragraph of the Greek inscription stated that two translations, one in the sacred and the other in the popular Egyptian language, would be found adjacent to it. The discovery of an alphabet was the first task. The demotic part of the inscription was first examined by de Sacy and Akerblad, and the signification of a number of the symbols ascertained. The hieroglyphic part was next carefully examined and compared with the demotic and Greek. At last, after much study, Champollion and Dr. Thomas Young, independently of each other, discovered the method of reading the characters (1822), and thus provided a clue to the decipherment of the ancient Egyptian writing.

Hieroglyphic characters are either *ideographic*, i.e. using well-known objects as symbols of conceptions, or *phonetic*, i.e. representing words by symbols standing for their sounds. The phonetic signs are again divided into alphabetical signs and syllabic signs. Many of the ideographic characters are simple enough; thus the figure of a man, a woman, a calf, indicate simply those objects. Others, however, are less simple, and convey their meaning figuratively or symbolically. Water was expressed by three zigzag lines, one above the other, to represent waves or ripples of running water; milk by a milk-jar; oil by an oil-jar; fishing by a pelican seizing a fish, i.e. fishing; seeing and sight by an eye; and so on. The nature of the phonetic hieroglyphs, which represent simply sound, will be understood from an explanation of the accompanying cuts.

1. The first hieroglyph in the name of Kleopatra is a knee, which is *kne* or *kle* in Coptic, and represents the K of Kleopatra. K does not occur in the name Ptolemaios. 2. The second hieroglyph in Kleopatra is a lion couchant, which is *laboi* in Coptic, and *labu* in the old Egyptian, and represents the L of both names. In Kleopatra it occupies the second place, and in Ptolemaios the fourth. 3. The third hieroglyph in Kleopatra is a reed, which is *aké* in Coptic, and *aak* in the old Egyptian, and represents the E of Kleopatra. The reed is doubled in Ptolemaios and occupies the sixth and seventh places, where it represents the diphthong ai of Ptolemaios. 4. The fourth hieroglyph in Kleopatra is a noose, which represents the O of both names, and occurs in the third place of Ptolemaios. 5. The fifth hieroglyph in Kleopatra is a mat, which represents the P of both names, and is the initial of Ptolemaios. 6. The sixth hieroglyph in Kleopatra is an eagle, which is *akhoom* in Coptic, and represents the A, which is found twice in the name Kleopatra, but does not occur in the name Ptolemaios, although the diphthong *ai* occurs as described above, No. 3. 7. The seventh hieroglyph in Kleopatra is a hand, which is *toot* in Coptic, and represents the T of Kleopatra, but does not occur in Ptolemaios, where it might be expected to occupy the second place. The second place of Ptolemaios is occupied by a semicircle, which is found at the end of feminine proper names, and is the Coptic feminine article T. The researches of Champollion satisfied him of the existence of homophones, or characters which have the same phonetic value and which might be interchanged in writing proper names.



Hieroglyphics The Egyptian Alphabet

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8. The eighth hieroglyph in Kleopatra is a mouth, which is *ro* in Coptic, and represents the R of Kleopatra. 9. The ninth hieroglyphic in Kleopatra is the eagle, which is explained in No. 6 above. 10. The semicircle is the T of Ptolemaios, which with 11, the egg found at the end of proper names of women, is a feminine affix. In the name of Ptolemaios there is still the M and

the S to account for. The fifth hieroglyph in the cartouche of Ptolemaios is a geometrical figure, consisting of three sides of (probably?) a parallelogram, but now called a hole, because the Coptic *mu* has that signification, and represents the M. The hook represents the S of the word Ptolemaios. Vowels were only regarded by the Egyptians as they were needed to avoid ambiguous writing.

There are groups of hieroglyphs of which one element is an ideographic sign, to which a phonetic complement is added to indicate the pronunciation of the ideographic sign. The words of a text could be written in hieroglyphs in three ways: (1) by phonetic hieroglyphs; (2) by ideographic hieroglyphs; and (3) by a combination of both. According to Ebers, in the perfected system of hieroglyphics the symbols for sounds and syllables are to be regarded as the foundation of the writing, while symbols for ideas are interspersed with them, partly to render the meaning more intelligible, and partly for ornamental purposes, or with a view to keep up the mystic character of the hieroglyphics.—BIBLIOGRAPHY: E. A. T. W. Budge, *The Literature of the Ancient Egyptians*; E. Revillout, *Chrestomathie démotique*; A. Erman, *Life in Ancient Egypt*; M. A. Murray, *Elementary Egyptian Grammar*; A. H. Gardiner, *Egyptian Hieratic Texts*.

Hieroglyphic Writing. See *Hieroglyphics*.

Hieron'ymites, or **Jeronymites,** hermits of St. Jerome (Hieronymus), an order of religious persons established in 1374, who wear a white habit with a black scapulary. They possessed the convent of St. Lawrence in the Escurial, and still have convents in Sicily, the West Indies, and South America.

High Church, a term applied to a party in the Church of England. It was applied first to a party among the younger clergy, during the latter part of the reign of Elizabeth, who asserted that Calvinism was inconsistent with the ancient doctrine and constitution of the primitive Church, and who claimed a divine right for episcopacy. Bishop Andrewes was the chief writer of this party, and Laud became its most active leader. The term now generally refers to those who exalt the authority and jurisdiction of the Church, and attach great value to ecclesiastical dignities and ordinances, being more or less identified with the ritualistic party. See *Ritualism*.

High Commision, Court of, an ecclesiastical court created by 1 Eliz. c. i. 1559, by which all spiritual jurisdiction was vested in the Crown. Under Charles I and Laud it assumed illegal powers, and was abolished in 1641.

Highgate, a suburb of North London, partly situated on a hill and commanding fine views of the surrounding country. It is 5½ miles from St. Paul's.

High German, originally the Teutonic dialect spoken in the southern and elevated parts of Germany, as distinguished from Platt Deutsch or Low German, spoken in the northern and more lowland portions of Germany. See *Germany*.

Highland Regiments are regiments originally raised and recruited in the Highlands of Scotland, and wearing the tartan either in the shape of kilts or trews. These regiments are, in order of seniority, the Black Watch (42nd and 73rd), the Highland Light Infantry (71st and 74th), the Seaforth Highlanders (Ross-shire Buffs, the Duke of Albany's, 72nd and 78th), the Gordon Highlanders (75th and 92nd), the Queen's Own Cameron Highlanders (79th), Princess Louise's (Argyll and Sutherland Highlanders, 91st and 93rd). The majority of these regiments were first raised in the latter part of the eighteenth century in order to deal with the situation arising out of the French Revolution, but the 42nd dates from the earlier part, and was originally raised in 1730 as independent companies of a sort of *gendarmerie* whose duty it was to keep a semblance of order in their respective districts. After an existence of some eight years in this form, these companies, of which there were six, were brought together and formed into a regiment of ten companies under the Earl of Crawford. The 73rd, the present 2nd battalion of the Black Watch, was raised in 1779 as the 2nd battalion 42nd, became the 73rd Regiment in 1786, and again became connected with the Black Watch on the introduction of the two-battalion system in 1881.

The Highland Light Infantry dates from 1777, when a regiment was raised by Lord Macleod and numbered the 73rd. In the reshuffling of numbers in 1786 it became the 71st, and in 1881 was joined with the 74th to form a two-battalion regiment.

The Seaforths take their name from the present 2nd battalion, which was raised as the 78th by Lord Seaforth in 1793. The 'letter of service' authorizing the raising of the 78th was dated 7th March, 1793, and the regiment was at full strength by 10th July the same year.

Of the Gordon Highlanders, the 1st battalion —the old 75th—was raised in 1787, and the present 2nd—the 92nd—in 1794. The latter was the fourth of a series raised by the Duke of Gordon, of which the three first had been raised for special purposes, and, as was the custom in those days, disbanded when no longer required.

The Cameron Highlanders date their origin from 1793, when a regiment of Cameronian volunteers was raised by Alan Cameron. In the following year the title was changed to the 79th Cameron Highlanders. At the reorganization of 1881 this regiment remained a single battalion till the early days of this century, when a second battalion was added.

The 91st—the 1st battalion of the Argyll and Sutherland Highlanders—was raised by the Duke of Argyll in 1794 as the Argyll Regiment, and was first numbered the 98th. Four years later the number was changed to the 91st, and in 1881, when the two-battalion system became universal, the 91st was joined with the 93rd to form the Argyll and Sutherland Highlanders.

All these regiments, with the exception of the Highland Light Infantry, wear the kilt.

Highlands of Scotland, a somewhat vague and indefinite geographical division of Scotland, north and west of a line running north-east from Dumbarton on the Clyde through the counties of Dumbarton, Stirling, Perth, Forfar, Kincardine; then north-west through Aberdeen, Banff, Moray, and Nairn to the shores of the Moray Firth. The Highlands are generally subdivided into two parts, the West Highlands and the North Highlands; the former of which contain the shires of Argyll and Bute, the Southern Hebrides, and part of Perth and Dumbarton; and the latter comprehend the counties of Inverness, Ross, Sutherland, the districts of Athol, Rannoch, and the Isles of Skye, Lewis, and others belonging to Inverness and Ross. The mountainous parts of Banff, Moray, Aberdeen, and Kincardine are also recognized as forming part of the Highlands; while Caithness (partly) and the Orkney and Shetland Isles are excluded, because their inhabitants are of Scandinavian origin. The whole of the district, which embraces the Celtic-speaking part of Scotland, is wild, rugged, and mountainous, with much grand and picturesque scenery. The western coast is indented by many narrow arms of the sea, and is flanked by numerous islands. Forming, by their natural characteristics, a region distinct from the Lowlands of Scotland, the Highlands were long in a state of political semi-independence, and socially and otherwise—and particularly in retaining the use of the Gaelic tongue—the people have still certain characteristics peculiar to themselves. What especially separated this region from the rest of Scotland was not only the Celtic language and blood, but also the clan system and all connected with it. See *Clan.*

In the earliest times the Highland chiefs gave allegiance to higher chiefs or princes, by whom the Scottish kings were acknowledged as sovereigns merely in name. Among these native princes were the powerful Lords of the Isles, who flourished from very ancient times to the reign of James V. They ruled over all the Western Islands (the Hebrides) from Islay north, and over the western part of the county of Inverness, and as powerful allies exerted an influence over the greater part of the Highlands. In the early part of the fifteenth century the Highlanders threatened to overrun great part of the Lowlands, but they received a check in the defeat of Donald of the Isles at Harlaw in 1411. From this time onward their incursions on the Lowland parts of Scotland were confined chiefly to occasional plundering raids. In the wars of the seventeenth century the Highlanders were largely engaged on the side of the Stuarts, and great numbers fought under both Montrose and Dundee. After the suppression of the rising of 1715 a strenuous attempt was made to break up the tribal organization of the Highlanders. An Act was passed in 1724 for their disarmament; between 1726 and 1737 great military roads were formed under the direction of General Wade, and a chain of fortified military posts constructed, to overawe the people. The chieftains made every effort to maintain their threatened power, and to destroy the effect of the innovations with which the Government sought to weaken the bonds of the clans, but the weakening went on. The rebellion of 1745 gave the Government an opportunity of hastening the process, by the abolition of heritable jurisdictions, and of the ancient privileges of the chiefs. A stringent law for disarming the people was passed, and they were even prohibited from wearing their national dress, a prohibition not formally removed till 1782. The great extension of sheep-breeding and the appropriation of large tracts to game have tended much to depopulate some parts of the Highlands. In other parts, notably in some of the Western Islands, the population has increased beyond a point where their circumscribed condition could support them, and much discontent, agitation, and trouble has been the result. (See *Crofters.*) The Highland dress, so well known at the present day, is modern in a good many of its features, and especially so in the great variety of tartans that have been invented, and of which each clan now appears to claim one. See also *Highland Regiments.*—Cf. Browne, *History of the Highlands and the Highland Clans.*

High Places, in Scripture, eminences or mounds on which sacrifices were offered. Altars and places of worship were erected from early times on high places, for the worship of Jehovah. Afterwards such a practice, as leading to idolatrous observances, was strictly forbidden among the Jews. High places are frequently mentioned in conjunction with *groves.*

High-priest, the head of the Jewish priesthood. In the books of Moses the holder of this dignity is simply designated the priest; the epithet *high* occurs on one or two occasions, but as a distinctive epithet it appears to have been added subsequently. The formal consecration of

Aaron, the brother of Moses, together with his sons, to an hereditary priesthood, is recorded in *Exod.* xxviii. The high-priesthood continued in the line of Aaron, sometimes in one, and sometimes in another branch of it, until the coming of Christ. From 153 B.C. till the time of Herod the Great the regal and priestly authority were united in members of the Asmonæan family (the Maccabees). After the subjugation of the Jews the high-priesthood was often arbitrarily conferred by the foreign masters. In the time of our Saviour it appears to have been held by several priests alternately.

High-seas, the open sea or ocean. The claims of various nations to exclusive rights and superiority over extensive tracts of the ocean-highway have been settled after much controversy by a general international law. The principle now accepted is that the jurisdiction of maritime states extends only for 3 miles, or within cannon range of their own coasts, the remainder of the seas being high-seas, accessible on equal terms to all nations. Inland seas and estuaries, of course, are excepted. See *Freedom of the Seas.*

High-speed Machinery, the general name given to rotating machinery which runs at speeds exceeding, say, 500 r.p.m. The earliest commercially successful high-speed prime movers were the reciprocating engines designed by Willans, Ferranti, and Belliss & Morcom. They are compound two- or three-cylinder vertical engines running at about 600 r.p.m. The next step in speed was taken with the impulse and reaction turbine of Parsons, Rateau, Curtis, and Zoelly. These machines run at speeds ranging from, say, 750 r.p.m. to 5000 r.p.m. High speeds of rotation are essential in turbines because the blades are attached to the periphery of the rotating member, and, to be efficient, the blades must run at speeds comparable with the speed of steam in the jets used. The steam speeds are often very high, some 1000 to 3000 feet per second. The next step in speed is a very long one, namely, to about 20,000 to 30,000 r.p.m. Speeds of this magnitude are used in the De Laval turbine. The design of such a machine is a very special problem, and the machine possesses many curious features, which the engineer is apt to look upon with suspicion. For instance, the De Laval machine for 10 horse-power has a flexible shaft about the thickness of a thick knitting-needle.

So far we have spoken of prime movers. High speeds are also used with centrifugal pumps, fans, electric motors, &c. The advantage of the high speed is that the weight of the machine for a given output is very roughly inversely proportional to the speed, unless the machine is a very small one, so that by using a high speed we get a light and cheap machine. In the design of high-speed machinery special attention must be given to two points, apart from the ordinary details of design which apply to all machinery. These special points are (*a*) the balancing of all forces which are due to centrifugal force; (*b*) the examination of the structure from the point of view of vibration. The bugbear of high-speed machinery is not so much the stresses set up by the high speed as the vibration it is apt to produce. The vibration can only be kept within permissible limits (1) if the disturbing forces are eliminated as far as possible, and (2) if the parts of the machine itself are very stiff against vibration.—BIBLIOGRAPHY: H. M. Hobart and A. G. Ellis, *High-speed Dynamo-electric Machinery*; H. M. Martin, *The Design and Construction of Steam Turbines.*

Hil'ary, or Hilarius, St., one of the early Fathers of the Church, born at Poitiers, of which city, after his conversion from heathenism, he became the bishop about A.D. 350. His contests with the Arians, which won him the epithet Athanasius of the West, caused his banishment to Phrygia, whence he returned after some years, and continued to distinguish himself as an active diocesan till his death in 367 or 368. He wrote *De Trinitate, libri xii.*

Hilary Term, one of the four English law terms. It begins on the 11th, and ends on the 31st of Jan.: named from the festival of St. Hilary, 13th Jan. In 1873 the name Hilary Sittings was substituted for Hilary Term. Hilary Term at Oxford University begins on 14th Jan., and ends on the Saturday before Palm Sunday.

Hilda, Saint, a grand-niece of Edwin, King of Northumbria, born about 614, died at Whitby in A.D. 680. At the age of fourteen she was baptized along with her royal kinsman by Paulinus. She was consecrated by Bishop Aidan, and was successively head of the abbey of Hartlepool and for twenty-two years of the famous monastery at Whitby. Cædmon, the Old English poet, was attached to the monastery during her rule.

Hildburghausen (hilt'bụr*h*-hou-zn), a town of Germany, in Saxe-Meiningen. From 1683 to 1826 it was the capital of the Duchy of Saxe-Hildburghausen. Pop. 7500.

Hildebrand. See *Gregory VII.*

Hilden, a town of Prussia, Rheinland, on the Itterbach, 9 miles E.S.E. of Düsseldorf, with thriving woollen and linen manufactures. Pop. 16,900.

Hildesheim (hil'des-hīm), a city of Prussia, province of and 20 miles from Hanover, the see of a bishopric, founded by Louis le Debonnaire in A.D. 818. It possesses a considerable trade and various industries. It was a free city till 1803. Pop. 58,499.

Hill, Sir Rowland, English postal reformer and originator of the penny postal system, born at Kidderminster 1795, died 1879. He was engaged as a schoolmaster till 1833, shortly after which he was appointed secretary to the Commissioners for the Colonization of South Australia. In 1837 he published a pamphlet recommending the adoption of a low and uniform rate of postage throughout the United Kingdom. The scheme was approved by a committee of the House of Commons, which examined it in detail in 1838, and in Jan., 1840, the penny postage system, which seems to have been originally proposed by James Chalmers, of Dundee, was carried into effect with the assistance of Hill, who, for this purpose, received an appointment in the Treasury. In 1846 he received a public testimonial of the value of upwards of £13,000. In 1846 he was made Secretary to the Postmaster-General, and in 1854 Chief Secretary to the Post Office. In 1860 he became K.C.B. He also invented a rotary press for printing newspapers, and the adhesive stamp. He retired from the Post Office in 1864 with a pension of £2000, besides a grant of £20,000 voted by Parliament.—Cf. E. C. H. Smyth, *Sir Rowland Hill: the Story of a Great Reform.*

Hill, Rev. Rowland, popular preacher, notable for his humour and eccentricities, son of Sir Rowland Hill, Bart., of Hawkstone in Shropshire, born 1744, died 1833. He was ordained in the Anglican Church, but embracing the views of the Calvinistic Methodists, he soon began to preach in barns and meeting-houses, and when they were too small or too distant, or not to be procured, in streets, fields, and highways. In 1783 he laid the foundation of Surrey Chapel in the Blackfriars Road, London, where he preached with great success every winter for about fifty years, making summer excursions to the provinces, where his preaching attracted immense crowds. He was one of the founders of the Religious Tract Society and the British and Foreign Bible Society. He published sermons and other theological works, of which the best known are his *Village Dialogues*, which passed through thirty-four editions in thirty years.

Hill, Rowland (Viscount Hill), British general, nephew of the above, born 1772, died 1842. He entered the army in his sixteenth year, was promoted captain in 1793, and became colonel of the 90th Regiment in 1800. He took part in the Egyptian campaign, and in 1806 was made major-general. He served with great distinction during the campaigns of Moore and Wellington in the Peninsula. In 1809 he became lieutenant-general; in 1812 he was made a G.C.B.; and in 1814, on being made a peer by the title of Baron of Almaraz and of Hawkstone, Parliament voted him a perpetual pension of £2000. At Waterloo he commanded the right wing of the British, and was personally thanked by Wellington for his services. In 1828 he was appointed general commanding-in-chief, the British army, a post which he held till 1842, when he retired and was created viscount. Viscount Hill was often styled 'the right hand of Wellington', and was also known as 'the soldier's friend', as he was greatly beloved by the troops.—Cf. A. E. Shand, *Wellington's Lieutenants.*

Hillah, or Hellah, a town of Mesopotamia, 60 miles south by west of Bagdad, on the Euphrates, among the ruins of ancient Babylon. It has good bazaars, and manufactures of silk and leather. The Euphrates is here crossed by a floating bridge. Pop. about 30,000.

Hillel, Jewish rabbi, born at Babylon about 80 or 60 B.C., died about 10 B.C., and according to others A.D. 10. He is known as 'the Babylonian' and also as 'the elder', to distinguish him from later teachers of the same name. He came to Jerusalem, it is said, at about forty years of age, became president of the Sanhedrin and founder of the school of Hillel. Shammai, another member of the Sanhedrin, became the head of a rival and hostile school. Hillel's party was the more liberal of the two, and became the dominant one. Hillel himself was greatly distinguished as a teacher of ethics. Among his numerous sayings is the following: "What is hateful unto thee do not unto others; this is the whole law, the remainder is only commentary".

Hill Tipperah, a native state, Hindustan, adjoining the British district of Tipperah, Eastern Bengal. The state is hilly, several ranges of hills running parallel from north to south, with broad intervening valleys. Wild elephants and other large game abound in the forests. The principal crop is rice, and tea is indigenous in some parts of the hills. The government is despotic and patriarchal, and a resident political agent protects British interests. Area, 4086 sq. miles. Pop. 229,600.

Himálaya (Skt. *Himálaya*, the abode of snow), a chain of snowy mountains in Asia, the most elevated on the earth, which separates the Indian Peninsula from the plateau of Tibet, between the 72nd and 96th degrees of E. long., or between the Indus on the west and the Brahmaputra on the east; length, about 1500 miles; average breadth, about 180 miles. The direction of the Himálaya range from the Indus is for great part of its length from north-west to south-east, after which it curves gradually to the east, or slightly to the north-east. The great plain of India, south of the Himálaya, has a general elevation of 1000 feet above the sea. The transition from this plain to the ascent of the range is marked in the north-west by a belt of dry porous ground broken up into numerous ravines. East of this the *Tarai*, a belt of sloping marsh land, occupies the same position. The *Tarai* is covered with forest and jungle, is crowded with wild animals, and is very malarial. Beyond this lies the *Bhabar*, a belt of a gravelly and sandy nature covered with forests of valuable timber trees. The *dúns*, *maris*, or *dwars*, longitudinal valleys partly cultivated and partly yielding forest growth, occupy the space between the *Bhabar* and the slope of the Himálaya themselves. The general height of the Himálaya is double that of the Alps; the passes over the former ordinarily exceed, often by half a mile, the elevation of Mont Blanc. The Ibi-Gamin Pass in Garhwal, the highest of all, is 20,457 feet, the Mustagh 19,019 feet, the Parangla 18,500 feet, the Kronbrung 18,313 feet, and the Dura Ghât 17,750 feet high. There are several summits in the Himálaya which approach closely to double the absolute elevation of the highest of the Alps, and 120 of them are stated to be above 20,000 feet. The rivers of the Punjab ('Five Waters') spring from a portion of the great chain which may be considered a distinct group under the title of the North-Western Himálaya. Some of the peaks here rise to a height of 24,000 to 25,000 feet; or to 28,278 feet if the Karakorum is regarded as part of the Himálaya. In the Central or Middle Himálaya rise the sources of the Ganges and Jumna, in a region regarded by the Hindus as holy ground. Farther eastward, in Nepal, is the highest part of the Himálaya, as far as it is known and measured. Dhawalagiri has an elevation of 26,826 feet, the Gaurisankar or Mount Everest, the highest known mountain in the world, is 29,002 feet; the Yassa group rises to the height of 26,680 feet, the Ibjibia group to 26,306 feet. Going farther east, in Sikkim, or on its borders, we find Kanchinjinga, the western peak of which is 28,156 feet high, the eastern 27,815 feet, while the Kábru ridge rises to 24,015 feet. Sikkim forms a comparatively narrow but interesting territory, walled in on three sides by stupendous mountains from 17,000 to 28,000 feet high. Here terminates the region of the Middle Himálaya, most of the streams from which unite in the Ganges. The Eastern Himálaya, which extends from Sikkim east to the Brahmaputra and completes the chain, sends all its waters to the last-named river, and is all comprised in Bhutan. A little to the east of Sikkim, Chamalari attains the height of 23,944 feet. About 250 miles farther east a conspicuous group has been observed with two peaks, named the Gemini or Twins, 21,500 feet high. Thence towards the east the mountains sink rapidly, but the range may be traced beyond the right bank of the Brahmaputra. This stream, as well as the Indus, rises on the little-known north side of the Himálaya, their sources not being far apart. The snowy ridge of the Himálaya, as far as examined, consists everywhere of granite, with which are immediately associated gneiss and mica-slate, followed, in descending, by metamorphic and secondary rocks till we arrive at the more recent alluvial deposits. Earthquakes are still frequent within this region; and hot springs gush forth in abundance, even from beneath the snow. The limit of perpetual snow in the middle division (long. 78° E.) is stated to be about 15,500 feet on the south side and 18,500 feet on the northern. In Sikkim the snow-line descends on the south side to 14,500 feet, while on the north it rises to a level of 19,600 feet. Immense glaciers exist at various parts. The vegetation of the Himálaya is very rich, there being forests of pine, spruce, silver-fir, and deodar cedar at suitable elevations, with rhododendrons in rich profusion. Among the more characteristic animals are the yak, musk-deer, and wild sheep.—BIBLIOGRAPHY: F. B. Workman, *In the Ice-World of Himalaya*; *Ice-bound Heights of Mustagh*; C. G. Bruce, *Twenty Years in the Himalaya.*

Himantha'lia, a genus of Brown Algæ, family Fucaceæ. *H. lorea*, the sea-thong, is plentiful on some parts of our coasts. The thallus proper is a small top-shaped disc and is perennial; from it grows up each year a long, repeatedly-forked fertile shoot or *receptacle*, each branch of which somewhat resembles a leather strap in appearance and texture; hence the scientific and popular names.

Him'era, an ancient Greek town on the north coast of Sicily, the site of which is near the modern Termini. Here Gelon and Theron annihilated the army of Hamilcar the Carthaginian (480 B.C.). In 409 B.C. Hannibal, grandson of Hamilcar, razed the town to the ground, and in 407 B.C. the Carthaginians built Thermæ Himerenses on the opposite bank of the River Himera.

Himyarites, the Homerites of Ptolemy, a group of peoples in Arabia, regarded as descendants of Himyar, one of the mythical ancestors of the Arabs. According to tradition they became the dominant race in Yemen about 3000 years before Mahomet, and spread to the Euphrates on the one hand and Abyssinia on the other. Their most flourishing period appears to have been from about 100 B.C. till A.D. 629, when they succumbed to Mahommedanism. The Mahrah tribes of Southern Arabia are the direct descendants of the ancient Himyarites.

Himyaritic Language, The, not now spoken, formed, with the Arabic and Ethiopic, the southern branch of the Semitic family of tongues.

During the last hundred years several hundreds of Himyaritic inscriptions have been collected, and deciphered by means of alphabets with the corresponding Arabic letters which had been preserved.

Hinckley, a town and rural district of England, in the county of Leicester. It lies 12 miles south-west of Leicester, and contains an ancient church. The staple trade is hosiery, but there are also large boot and shoe factories. Pop. 13,644.

Hincmar, Archbishop of Rheims, ecclesiastic and statesman, was born about A.D. 806, died at Epernay 882. He was at first a monk in the Abbey of St. Denis. In 845 he was elected Archbishop of Rheims, where he exercised extensive political as well as ecclesiastical authority. He was a man of enlightenment, one of the best scholars of his age, and was distinguished as a defender of the liberties of the Church. He was an opponent of predestinarianism, and wrote two treatises on it, and numerous other works.—Cf. J. C. Prichard, *Life and Times of Hincmar.*

Hindenburg, Paul von, German soldier, born at Posen 1st Oct., 1847. Educated at the Military College, he entered the Prussian army in 1865, and served both in the Austro-Prussian and Franco-Prussian Wars. He distinguished himself at Königgratz, St. Privat, and at the battle of Sedan. He became major-general in 1900, rose to the rank of general of infantry, and retired from the army in 1911. When the European War broke out, Hindenburg was living in retirement in Hanover, but was recalled and appointed commander of the German forces in East Prussia. He defeated the Russians at the battle of Tannenberg, and pursued them to the Niemen. Appointed commander-in-chief of the Austro-German forces in Poland, he attacked Warsaw in Oct., 1914, and again in November of the same year, when he defeated the Russians at Kutno (15th–16th Nov.). Hindenburg became the idol of Germany, and it was considered a pious act to drive nails of homage into his wooden effigy in Berlin. Commander-in-chief of the Austro-German forces on the Eastern front in 1915 and 1916, he became German generalissimo on 30th Aug., 1916, but accomplished little in the West. He retained this position till 11th Nov., 1918, when the Armistice was signed. He was decorated with the Iron Cross and made a Field-Marshal in 1914. In July, 1919, he wrote to Marshal Foch and offered himself as a sacrifice for the ex-Kaiser, and in November of the same year he gave evidence as to the responsibility for the European War before the Reichstag Committee. His work *Out of My Life* appeared in 1920.

Hindi, one of the languages of India, being that form of Hindustani which employs the Devanágari or Sanskrit character. There are many varieties of it. Hindustani, the *lingua franca* of India, developed out of one of its dialects.

Hindley, a town of England, in Lancashire, giving name to one of the parliamentary districts of s.w. Lancashire. Cotton manufacture is the chief industry, and coal is mined. Pop. 23,574.

Hinduism is a general term covering a vast number of various and often very discrepant cults and socio-religious systems of Hindustan, which have in some cases developed out of the religion of the Aryan tribes who made their way into the north-west of India at least 1000 B.C. (perhaps considerably earlier), and in other cases represent the religious ideas of certain races settled before the Aryans in Hindustan—Dravidians, Kolarians, &c., who have in greater or lesser measure accepted certain fundamental ideas from the Aryans.

The earliest document of the religion of the Aryans is the *Rig-vēda*, a collection, in ten books, of 1017 hymns by various priestly poets, which reveal the Aryans as dwelling at the time in the north-west of Hindustan, probably for the most part in the Eastern Punjab, in a state of civilization very much like that of the Homeric Greeks. These hymns are mostly addressed to the chief gods of the Aryan pantheon, who are in some cases nature-powers with a thin veil of anthropomorphic personality, such as Dyaush-pitā the Sky-father (phonetically equal to Ζεὺς πατήρ, but in character very shadowy and impersonal), Prithivī the Earth-mother, Ushas the Dawn-goddess, Parjanya the god of the Rain-storm, Sūrya the Sun-god, Vāyu the Wind-god; in other cases they are essentially personal deities of uncertain origin, such as Indra, the most popular of the gods, typifying the hard-fighting and hard-drinking Aryan, whose chief exploit however, the destruction of the Dragon Vṛitra and the liberation of the Cows or Waters, seems to suggest an origin in nature-myth, and Varuṇa, whose chief function is to guard the moral order of the world; others again, frankly physical in origin, have developed special features in religious practice, such as Agni the Fire-god, who, as conveying to the gods the oblations cast into the sacred fire, has became the divine Priest, and Sōma, the spirit of an unknown plant of which the fermented juice was drunk in various rites to inspire mystic ecstasy. Among other gods worshipped were Vishṇu, a kindly deity of obscure origin, and Rudra (later more commonly styled Śiva, 'The Gracious', on the principle of *lucus a non lucendo*) a spirit inclined to malignity. The rites connected with these cults were in earlier times fairly simple, but gradually they became more and more elaborate. The numbers of priests employed, the Brahmans, grew to large proportions, and their functions came to be subdivided; details of ceremony were intricately elaborated in a spirit of ritualistic professionalism, which considered the sacrifice as an end in itself, capable of controlling the order of nature at the will of the sacrificant, and which regarded the accompanying Vedic hymns merely as catchwords or spells for the mechanical purposes of the rites. To expound these ideas there arose a voluminous literature (at first oral, as was the Vēda), known as the *Brāhmaṇas.* During this period the Aryan division of society into the four castes or *varṇas* (literally ' colours '), viz. Brahmans or spiritual leaders, Kshatriyas or warriors, Vaiśyas or traders, and Śūdras or serfs, came to be fixed as a part of the social and religious order; and also the first steps were taken towards the establishment of a doctrine which has become universal in Hinduism, viz. the doctrine that the moral quality of every act inevitably and mechanically causes the agent to suffer corresponding happiness or sorrow in time to come (*karma*), and that the soul transmigrates and passes from birth to birth, higher or lower, in strict accordance with the merit of its previous works (*saṃsāra*).

The ritualism of the Brahmans developed in two directions. On the one hand, orthodoxy carried on its principles through the ages with little change, except that the loss of patronage compelled it to curtail and ultimately to abandon most of the expensive and complicated public rites. The principles of these schools are summed up in the *Pūrvamīmāṃsā*, aphorisms ascribed to the sage Jaimini, with their commentaries by various scholars. To this day there exist, especially in Southern India, numerous Brahman families who preserve this tradition and maintain on a modest scale the ancient rites of domestic sacrifice. On the other hand, many Brahmans (possibly influenced by thinkers of the Kshatriya caste) advanced through divers allegorical interpretations of the rites of sacrifice to idealistic conceptions of the universe, expressed in the *Upanishads* (*Vēdānta*). The Upanishads were later summarized in the *Brahma-sūtra*, which with its commentaries forms the *Uttaramīmāṃsā.* Their ultimate teaching is that the individual soul, the Self (*ātman*), is in essence one with the universe and the World-spirit Brahma, and that by the mystic intuition in which the soul realizes this unity it attains salvation, viz. immunity from future births and certainty of coming after death to the Infinite Brahma. The loose and often poetical style in which the Upanishads express this thought has led to great divergence between different schools of commentators, of whom some, headed by Śaṅkara (born *c.* A.D. 788), maintain a thorough monism or *Advaita*, explaining away the phenomenal world as illusion or *māyā*, while others, under the leadership of Rāmānuja (died A.D. 1137), preach a theism in which the absolute unity of the Supreme Being is qualified by the admission of a relatively real world of individual souls and matter (Viśishtâdvaita). Other interpreters hold other views; there is even a system of dualism, taught by Madhva or Ānanda-tīrtha (A.D. 1199–1278), who asserts an eternal and essential distinction between God, spirit, and matter. Though thus variously interpreted, the Upanishads have come to be recognized as the prime source of authority for all the higher religious systems of India. Many thinkers have accepted them without further religious admixture as guides in life and death; others have combined them with the theistic worship of *Śiva*, *Vishṇu*, *Rāma*, *Kṛishṇa*, and other gods.

These theistic cults seem for the most part to have arisen outside the Established Church of the Brahmans, but were adopted by the latter and recognized as orthodox as soon as they had become formidable rivals. They have practically ousted the old cults and rites of the Vēda and Brāhmaṇas, except in limited circles. The worship of Śiva (the Vedic Rudra) is founded upon terror: white or yellow of hue, with a blue throat, smeared with ashes, wearing a garland of skulls, accompanied by bands of hideous goblins, he dwells in the wilds of the Himâlaya, and his wife is Umā (Durgā or Pārvatī) the daughter of the god of these mountains. He has thus become the ideal Yōgī or ascetic saint, and he is commonly regarded as the power that brings about the dissolution of the universe in each æon of its beginningless and endless course. His worship is widely spread, being found with its phallic symbols (the *liṅga* and *yōni*, representing respectively the male and the female organs of generation) in almost all parts; it is especially strong in the extreme north and in the Dravidian regions of the south, except the Telugu country.

Vishṇu on the other hand developed early into a god of gracious and beautiful attributes. His chief consort is the goddess Śrī or Lakshmī (Fortune), and he is generally regarded as representing the forces of order in the cosmos. Of his incarnations or *avatāras* for the preservation and regeneration of the world the most important are those in which he appeared as Rāma and Kṛishṇa. Originally the cults of Rāma and Kṛishṇa were quite distinct from that of Vishṇu. Rāma is a local hero of Aydōhyā (near the modern Ajodhya, in Fyzabad District); the famous epic *Rāmāyaṇa* narrates his exploits —his exile in company with his faithful wife Sītā and his brother Lakshmana in consequence of his father's Daśaratha's rash vow, the rape of

Sītā by the demon king Rāvaṇa of Laṅkā, and Rāma's successful expedition to recover her, in which he was aided by a host of apes led by Hanumān—and in the portions of this poem which were composed later than the main body of the narrative he is represented as an incarnation of Vishṇu.

The cult of Krishṇa is composite. Possibly he was a real person, a prince of the Satvat clan, who, on account of his religious and moral teaching (or perhaps for other reasons) was worshipped after death, under the title of Bhagavān, 'The Lord', by sects called Bhāgavatas, Sātvatas, Pāñcharātras, &c., and in course of time was identified with Nārāyaṇa and Vishṇu. The great document for this apotheosis is the *Bhagavad-gītā,* which has been inserted into the great epic *Mahā-bhārata.* With these traditions has been combined a cycle of Arcadian and erotic stories describing the childhood and youth of Krishṇa among the herdsfolk of Vraja (*Bhāgavata-purāṇa,* &c.). With these gods is associated a vast mass of legend and ritual, mostly recorded in Purāṇas and other religious works. But they do not by any means exhaust the resources of Hinduism. It has a crowd of other deities, ranging from important personalities such as Brahman the Creator, Sarasvatī the goddess of learning, Ganēśa or Gaṇapati the remover of obstacles, and the war-god Skanda (Kumāra or Kārttikēya, the son of Siva), down to insignificant and nameless local godlings, each with rituals and legends of his own, but all more or less definitely recognizing and recognized by the laws of the Greater Gods' pantheon.[1]—BIBLIOGRAPHY: Monier Williams, *Religious Thought and Life in India*; J. C. Oman, *Cults, Customs, and Superstitions of India*; J. Murray Mitchell, *Hinduism, Past and Present*; J. N. Farquhar, *Primer of Hinduism*; R. W. Frazer, *Indian Thought, Past and Present*; E. O. Martin, *The Gods of India.*

Hindu Kush, or **Indian Caucasus,** a mountain system of Central Asia It is generally considered as a continuation of the Himálaya, which it adjoins at the Indus, and then stretches west till it unites with the Ghur Mountains in North Afghanistan. Its culminating point, in the range of Hindu-Koh, to the north of Kabul, is far beyond the limit of perpetual snow, but is not supposed to exceed 20,000 feet. In many features the Hindu Kush resembles the Himálaya proper, though it is lower and destitute of forests.

Hindu Law is in the main based upon the *dharma* or social-religious order prescribed by the Brahmans for Aryan society, and the books in which it is laid down arose at a time when the Aryans, settled in North India, and in some degree mixed with the darker races who inhabited the land before their coming, were developing the peculiar Indian social system denoted by the word *caste,* while preserving the patriarchal character of the household. The textbooks are of various ages: the oldest were probably composed several centuries B.C. The 'Laws of Manu' (*Mānava-dharma-śāstra*) may perhaps be of the second or third century A.D.; the *Yājñavalkyasmriti* is possibly of the fourth century A.D. But the administration of law has always had to take account of local usage, both Aryan and non-Aryan, and particularly Dravidian; an example of the latter is the law of succession in parts of the South, which follows the female line, in accordance with the ancient rule of Dravidian society, and in defiance of the Hindu law-books.

The unit of Aryan society was the joint household or family, comprising the patriarch with his wives, his unmarried daughters, and his sons with their wives and descendants; but in the course of time the patriarchal authority and the unity of the household have undergone some limitations. Women theoretically were always in tutelage, but had certain rights of inheritance and personal property. Widows as a rule were not expected to marry again; the custom of widows burning themselves on their husbands' pyre (*satī*), though without Vedic authority, became common in aristocratic circles, but was forbidden when the woman was pregnant or had a young son to educate. Polyandry was contrary to usual Brahmanic law, but was not unknown in some quarters. Infant marriage, though not practised in the earliest times, later became and is now very common, the bride remaining until puberty with her parents.

Legal, moral, and religious responsibilities were graduated according to the degrees of caste. The theory of caste, based upon one of the later hymns of the Ṛig-vēda (X, 90), is that Aryan society consists of the Brahmans as its spiritual and intellectual leaders, the Kshatriyas (warriors) as its defenders, the Vaiśyas (farmers and traders) as its 'middle class', and the Śūdras (serfs and villeins, mostly of non-Aryan blood) as its lowest class of workers. Some general division of this kind seems to have existed already in the early days of Aryan settlement in India; but centuries passed before it established itself as an imperative law with a divine sanction. The system is fissiparous; each caste, following its own peculiar rules of endogamy and its social-religious constitution, tends to subdivide itself into equally exclusive minor societies based mainly upon the vocation of their members, or upon the issue of cross-marriages for which the existing order has made no provision, or upon the result of new political, religious, or social conditions. There are now more than 400 castes in India, and the number tends to grow.

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[1] In the above survey we have omitted mention of Buddhism and Jainism. Though both these systems are developed from certain currents of early Hindu thought, their attitude towards official Hinduism in nearly all its forms has been one of nonconformity. Space forbids more than passing mention of the modern reformed theistic churches (Brāhma Samāj, Ārya Samāj, &c.).

Hindustan′ (country of the Hindus), the name commonly given to the whole Indian Empire, but which properly applies only to the Punjab and the valley of the Ganges. See *India.*

Hindusta′ni, the *lingua franca* of India, one of the chief languages of the country. It is analytic in structure, and is divided into nearly sixty sub-dialects. Hindustani is the vernacular of about 100 million people. When written in the Persian character, and containing many Persian words and phrases, it is known as Urdu; another form of it is Hindi.

Hinny, a hybrid, the produce of a stallion-horse and a she-ass. It is more docile but smaller and weaker than the mule produced by a jackass and a mare, and it is also much less common.

Hio′go (modern: **Hyogo**), suburb of Kōbe, Japan. Hiogo was the Japanese capital in the twelfth century, and was a flourishing place before Kōbe was in existence. As in the case of Yokohama, on the decision to erect Kōbe as a Treaty Port, Hiogo was absorbed (1887). See *Kōbe.*

Hip-joint, a ball-and-socket joint formed by the reception of the globular head of the femur or thigh-bone into the socket or acetabulum of the os innominatum. For flexion, extension, rotation, and strength combined it is the most perfect joint in the body.

Hippar′chus. See *Hippias.*

Hipparchus, ancient Greek mathematician and founder of scientific astronomy, was born at Nicæa in Bithynia, and lived about 160–125 B.C. He resided for some time at Rhodes, but afterwards went to Alexandria, then the great school of science. *A Commentary on the Phænomena of Aratus* is the only work of his extant. He first ascertained the true length of the year, discovered the precession of the equinoxes, determined the revolutions and mean motions of the planets, and prepared a catalogue of the fixed stars.—Cf. Sir G. C. Lewis, *Historical Survey of the Astronomy of the Ancients.*

Hippa′rion, a fossil genus of the horse family, of the Upper Miocene and Pliocene periods. The members are distinguished by the fact that each foot possesses a single fully-developed toe, bordered by two functionless toes which do not touch the ground, but simply dangle on each side of the central toe. The hipparion was between the size of an ass and that of a zebra.

Hip′pias, ruler of Athens, son of Pisistratus, after whose death (527 B.C.) he assumed the government, in conjunction with his brother Hipparchus. The latter being assassinated while conducting a solemn procession to the temple of Minerva, Hippias seized the reins of the government alone, and revenged the death of his brother by imposing taxes on the people, selling offices, and putting to death all of whom he entertained the least suspicion. His tyranny became at last unbearable, and he was expelled from the city 510 B.C.

Hippo, sometimes called **Hippo Regius** to distinguish it from another town of the same name on the Carthaginian coast; an ancient Numidian city, the ruins of which still exist a short distance south of Bona, in Algeria. It was the episcopal see of St. Augustine, and was destroyed by the Vandals in 430, and by the Moslems in the seventh century.

Hippobos′cidæ, or **Pupipara**, a family of dipterous insects, parasitic on birds and quadrupeds; also on bees. The eggs develop internally and come into the world as nearly mature larvæ (puparia). The type is *Hippobosca equina*, the horse forest-fly. Here also belong the fowl-fly (*Ornithomyia avicularia*), with the wingless ked or sheep ‘ tick ’ (*Melophagus ovinus*) and bee-louse (*Braula cæca*).

Hippocam′pus, a genus of fishes, closely allied to the pipe-fishes, of singular construction and peculiar habits; the upper parts have some resemblance to the head and neck of a horse in

Hippocampus, or Sea-horse

Phyllopteryx eques above. *Hippocampus brevirostris* below.

miniature, which has suggested the name. When swimming, they maintain a vertical position and progress by rapid lateral movements of the dorsal fin; their general length is from 6 to 10 inches, and they occur in the Mediterranean and Atlantic.

Hippoc′rates, the most famous among the Greek physicians, called the father of medicine, born in the Island of Cos 460 B.C. Besides practising and teaching his profession at home he travelled on the continent of Greece, and died at an advanced age, 357, B.C., at Larissa, in Thessaly. His writings, which were early celebrated, as they are quoted by Plato, became the nucleus of a collection of medical treatises by a number of authors of different places and periods, which were long attributed to him, and still bear his name. These works, seventy-two in number, include treatises by his sons Thessalus and Draco, by Polybus, and others. The best edition is that of Littré (in 10 vols. 8vo, Paris, 1839–61). An English translation of *The Genuine Works of Hippocrates* was published by Adams in 1849. Among his genuine writings are the first and third books on epidemics; the aphorisms; on diet in acute diseases; on air, waters, and localities; on prognostics; on wounds of the head. Hippocrates was one of the first to insist on the importance of diet and regimen in disease. He had remarkable skill in diagnosis, practised auscultation, and taught the doctrine of ‘ critical days ’.

Hippocrat′ic Oath, an oath taken in olden times by students on entering upon the practice of medicine. It commenced with the words: “ I swear by Apollo, the physician, by Æsculapius, by Hygieia, Panacea, and all the gods and goddesses, that according to my ability and judgment I will keep this oath, and stipulation ”. The would-be practitioner promised to pass his life in purity and holiness, to practise his art honestly and to the advantage of his patients, in accordance with the principles of honour and humanity. He furthermore pledged himself never to divulge the secrets of his profession. The oath is said to have been administered by Hippocrates himself to his disciples, and hence the name.

Hippocrene (-krē′nē; ‘ The Horse's Fountain ’), a spring on Mount Helicon, a mountain in Bœotia, consecrated to the Muses, the waters of which possessed the power of poetic inspiration. It is said to have risen from the ground when struck by the hoofs of Pegasus.

Hip′podrome (Gr. *hippos*, horse, and *dromos*, race-course), the Greek name for the public place where the horse- and chariot-races were held. In Byzantine times the hippodrome at Constantinople acquired great renown, and factions originating in the hippodrome caused perpetual confusion in all departments of the public service. The name is sometimes applied to a modern circus, and also to a theatre of variety entertainments, such as the London Hippodrome (opened in 1900).—Cf. E. N. Gardiner, *Greek Athletic Sports and Festivals.*

Hippol′ytus, in Greek mythology, son of Theseus and Antiope or Hippolyte, queen of the Amazons. His stepmother, Phædra, fell in love with him, and accused him to his father in order to revenge herself for his indifference. He was put to death, but his innocence being afterwards established, Phædra destroyed herself. According to a tradition of Epidaurus, Hippolytus was restored to life by Æsculapius. The story is told by Euripides in his drama *Hippolytus,* and by Racine in *Phèdre.* See *Phædra.*

Hippolytus, an early Christian bishop and writer, the details of whose history are involved in obscurity. He appears to have lived about the beginning of the third century, and is supposed to have suffered martyrdom under Alexander Severus. The most important of his writings is the *Philosophumena,* a refutation of heresies, discovered at Mount Athos in 1842, and published in 1852. He also wrote *Christ and Antichrist.*

Hippom′ane, a genus of plants belonging to the Euphorbiaceæ. The *H. Mancinella* is the manchineel.

Hippo′nax, a Greek satirist, lived probably about 540 B.C. He is supposed to have been undersized and ugly, and, like many men of small dimensions, endowed with a caustic wit. The sculptor Bupalus was the chief butt of his satire. Bupalus had made a statue of him in which he had intensified his already remarkable ugliness; Hipponax retaliated in satirical verses full of withering scorn. According to some authorities, Bupalus was so overwhelmed by this attack that he committed suicide; this feature of the story is, however, probably derived from the tale of Archilochus and Lycambes.

Hipponax is chiefly celebrated for introducing or inventing a new metre, that curious variant of the iambic senarius which is obtained by substituting a spondee or a trochee for an iambus in the last foot, and which is known as the choliambic, scazon, or limping iambic. This metre is extremely suitable for playful satire, and was used to the exclusion of other metres by Babrius in his *Fables*, and Herodas in his *Mimes*, and by Catullus in some of his poems (e.g. *Carmen VIII*, *Carmen XXII*, and the beautiful poem on Sirmio, *Carmen XXXI*).

Hipponax was notorious for the bitterness of his satire, although in a well-known epigram Theocritus warns the wicked to beware of his tomb, but says that good men may even sleep there without fear. With unerring taste Theocritus wrote this epigram in scazons, even as Wordsworth wrote his three poems on Burns in one of Burns's favourite stanzas. The fragments of Hipponax which have been preserved amount in all to about a hundred lines.

Hippoph'agy (Gr. *hippophagos*, horse-eating), the practice of feeding on horse flesh. Hippophagi was the name given by old geographers to certain nomadic Scythian tribes on the north of the Caspian Sea, who fed on horse flesh. Horse flesh has been eaten for a considerable time in Germany, and in Paris, where Geoffroy St. Hilaire founded a society of hippophagists, it has been regularly sold since 1866.

Hippopot'amus, the typical genus of a family of non-ruminating artiodactyle Ungulates, of which two living species are known. One species, *H. amphibius*, is of large size, and is common throughout the greater part of Africa, but has become extinct in Madagascar; the other, *H. liberiensis*, is not only smaller, but has other important differences, and is found only in the African west coast rivers, and those flowing into Lake Tchad. The former species has a thick and square head, a very large muzzle, small eyes and ears, thick and heavy body, short legs terminated by four toes, a short tail, two ventral teats, skin about 2 inches thick on the back and sides, and without hair, except at the extremity of the tail. The incisors and canines of the lower jaw are of great strength and size, the canines or tusks being long and curved forward. These tusks sometimes reach the length of 2 feet and more, and weigh upwards of 6 lb. The animal is killed by the natives partly as food, but also on account of the tusks and teeth, their hardness being superior to that of elephant ivory, and less liable to turn yellow. The hippopotamus attains the length of 14 feet, or possibly more. It delights in water, living in lakes, rivers, and estuaries, and feeding on water-plants or on the herbage growing near the water. It is an excellent swimmer and diver, and can remain under water a considerable time. The *behemoth* of Job is considered by commentators to be the hippopotamus, as the description of its size, manners, food, and haunts is not unlike those of the latter animal. Among the ancient Egyptians it was revered as a divinity, as it is among the negroes in some localities. The oldest extinct species occur in the Lower Pliocene of India and Burma, while during the Late Pliocene and Pleistocene periods *H. amphibius* (or a closely-related form) lived in Western, Central, and Southern Europe. The remains of extinct dwarf species are found in the Pleistocene of Sicily, Malta, and Madagascar.

Hippopotamus

Hippuris. See *Mare's-tail.*

Hippurites (-ī'tēz), a genus of fossil bivalve molluscs, often of massive dimensions, having the under shell of great depth, and of a conical form, with a flat lid or operculum. They are of the Upper Cretaceous age. They are allied to the living Chama, or gaping cockle. The *Hippurite limestone* is an important representative of the Cretaceous rocks in the south of France, the Austrian Alps (Gosau beds), &c., characterized by an abundance of shells of the family Hippuritidæ.

Hiring (known in the law of England as bailment for hire, and in the law of Scotland as location) is a contract whereby the possession of a subject is ceded by its owner (the locator or lessor or letter) to another person (the conductor or lessee or hirer) for a specified period for his use and enjoyment (*locatio rei*), or whereby services are rendered as by a clerk or workman (*locatio conductio operarum*), or a particular piece of work done as by a shoemaker employed to mend shoes (*locatio conductio operis faciendi*) in return for a hire or price.

Locatio rei is distinguished from sale in that there is no transfer of the ownership of the subject, and from borrowing in that there is a consideration for the use. The subject may be land or houses (see *Landlord and Tenant*; *Lease*) or any moveable subject or chattel capable of being returned. It cannot, therefore, strictly be anything which is consumed by use, as corn, wine, money, &c., though it may be something which suffers depreciation by tear and wear, as furniture. The use must not be for an illegal or immoral purpose. The obligations of the parties are generally as follows. The letter undertakes to do nothing inconsistent with the hirer's use and possession for the agreed-on period of the let, warrants the subject as fit for the use for which he has let it, and must keep it in adequate repair; whilst the hirer must return the subject at the expiry of the period in the like condition in which he received it (excepting always ordinary tear and wear), is liable in damages if, by putting it to any other use than that stipulated for, it is injured or destroyed, and in his use of it must exercise the care of a prudent man for his own property.

A special form of the contract is known as hire-purchase. Under this system the goods become the property of the hirer when he has paid the hire for a specified number of terms. Should he fall into arrears, the goods are recoverable by the letter, and all payments already made are forfeitable. Until the final payment has been made, the hirer is not owner and cannot sell or pledge the goods. They are, however, subject to distraint for rent. The system is much resorted to by persons of restricted means who wish to obtain immediate possession of expensive articles such as pianos, sewing-machines, &c., without immediate payment. See *Master and Servant*; *Carrier*; *Innkeeper*.

Hiring of custody occurs when goods are delivered to a wharfinger, warehouseman, livery stabler, &c., for safe custody in return for payment. The custodier must show ordinary care and diligence, and is liable for loss caused by his negligence.

Hirschberg (hirsh'ber*h*), a town of Germany, in Silesia, 26 miles south-west of Liegnitz, beautifully situated at the confluence of the Bober and the Zacken. It is well built, and has varied manufactures. Pop. (with suburbs), 20,560.

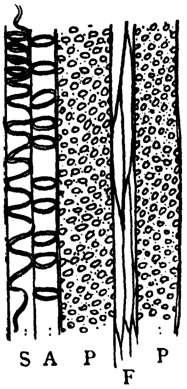
Hispania, the name by which the Spanish Peninsula was known to the Romans. The Greeks called it Iberia, and the Roman poets sometimes applied to it the name of Hesperia. See *Spain*.

Hissar', a town of Hindustan, in the Punjab, administrative head-quarters of the district of the same name, on the Western Jumna Canal, 102 miles w. of Delhi. Pop. 17,000. The district has an area of 5217 sq. miles. Pop. 805,000.—Hissar is also the name of a district and town in Turkestan, in E. Bokhara, having the Hissar chain on the north, and intersected by tributaries of the Oxus. Pop. of town, 10,000.

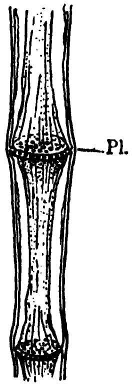
Histol'ogy, in biology, the study of the cell aggregates or *tissues* composing the bodies of higher organisms, and specialized for diverse functions in accordance with the principle of division of physiological labour. The lowest plants and animals consist of single cells, which are sometimes complex, while in multicellular organisms there is gradual differentiation of cell-groups, which reaches its climax in seed-plants and vertebrate animals.

Plant Histology.—Typical plant cells are invested by firm membranes or *cell-walls*, which vary in thickness and chemical composition in the different tissues. In some cases the protoplasmic contents entirely disappear, being used up in formation of the thickened cell-walls, which play a passive part in the economy. The following tissues are those of most importance. A. *Meristem.* Actively dividing tissue composed of small cells with thin cellulose walls and abundant protoplasm. The products of their division become modified in various ways, and add to the bulk of the plant by becoming permanent tissue. (1) *Primary meristem* entirely composes the bodies of very young embryos and organs, and also the growing points of root and stem, enabling these to increase in length. (2) *Secondary meristem*, existing as layers or masses intercalated among permanent tissues. *Cambium*, for example, is found in the roots and stems of Gymnosperms and Dicotyledons, between wood and bast, to both of which it makes successive additions that bring about growth in thickness among perennial forms. *Cork cambium* (phellogen) comes into existence in the periphery of thickening roots and stems, developing layers of cork which replace the epidermis when this is ruptured and shed as the result of expansion. Pollen grains and embryo sacs are also the products of minute masses of secondary meristem situated, respectively, within anthers and ovules. B. *Permanent Tissues.* (1) *Piliferous layer* and *epidermis.* The former is a delicate membrane, composed of a single layer of flattened cells, that invests young roots. A little way behind the apex of the root there is a zone where these cells are drawn out into delicate *root-hairs*, which absorb water from the soil. Leaves and young stems are covered by a somewhat similar investment of *epidermis*, typically made up of a single layer of flattened cells, the outer walls of which are more or less thickened and *cuticularized*, i.e. converted into *cutin*, a modification of cellulose which is practically waterproof and serves to prevent undue evaporation. Epidermis is transparent, so that light can reach the underlying green tissue. Microscopic holes, *stomata*, are present in the epidermis of the stem and under side of the leaf, less frequently in the upper epidermis of the latter. Through these pores gaseous exchanges can take place between the interior of the plant and the external air.

Each stoma is bounded by two kidney-shaped *guard-cells*, which contain chlorophyll granules, and by alterations in shape regulate the size of the cleft between them. *Hairs* of different shape and nature are often present as outgrowths of the epidermis. (2) *Vessels and tracheides.* Wood largely consists of microscopic tubes, *wood vessels*, developed from longitudinal rows of cylindrical cells by thickening and lignification of their walls, absorption of the cross partitions, and disappearance of the protoplasm. Thin places, *pits*, are left in the thickened walls, or the thickened part may be in the form of rings or a spiral (pitted, annular, and spiral vessels). *Tracheides* are dead, elongated cells, that take the place of vessels in the wood of Gymnosperms, but are not limited to this group of plants. *Bast vessels*, or *sieve tubes*, are conducting elements typical of bast, and are developed, like wood vessels, from longitudinal rows of cells. Their thickened walls, however, are composed of cellulose, and they contain protoplasm. The cross partitions are not absorbed, but perforated by numerous holes, owing to the presence of which they have received the name of *sieve plates*. The holes are traversed by threads of protoplasm. (3) *Parenchyma* is made up of cells which, in the most typical cases, are fairly equal in length, breadth, and thickness. They are characteristic of cortex, medullary rays, and pith, where their walls are usually of cellulose, and protoplasmic contents are generally present, though these may disappear in old pith. Small-celled parenchyma also occurs in wood and bast, its walls being lignified in the former. The green external tissue containing chlorophyll is of parenchymatous nature. In the leaf there is a compact upper layer of *palisade parenchyma*, with cells elongated at right angles to the surface, and lower *spongy parenchyma*, where numerous air-spaces are present between the irregular constituent cells. (4) *Collenchyma* is a supporting tissue found in the superficial parts of herbaceous structures, and may be described as a modification of parenchyma composed of prismatic cells, with thickened edges to the prisms. (5) *Fibrous tissue*, of supporting nature, consists of elongated spindle-shaped dead cells, with lignified walls, most abundantly found in wood and bast. Tissue of this kind belongs to what is commonly known as *sclerenchyma*, shorter-celled varieties of which often make up strengthening layers in the cortex of the stem, and also invest the vascular bundles of leaves, connecting them with upper and lower epidermis, and thus preventing collapse of the delicate green parenchyma.



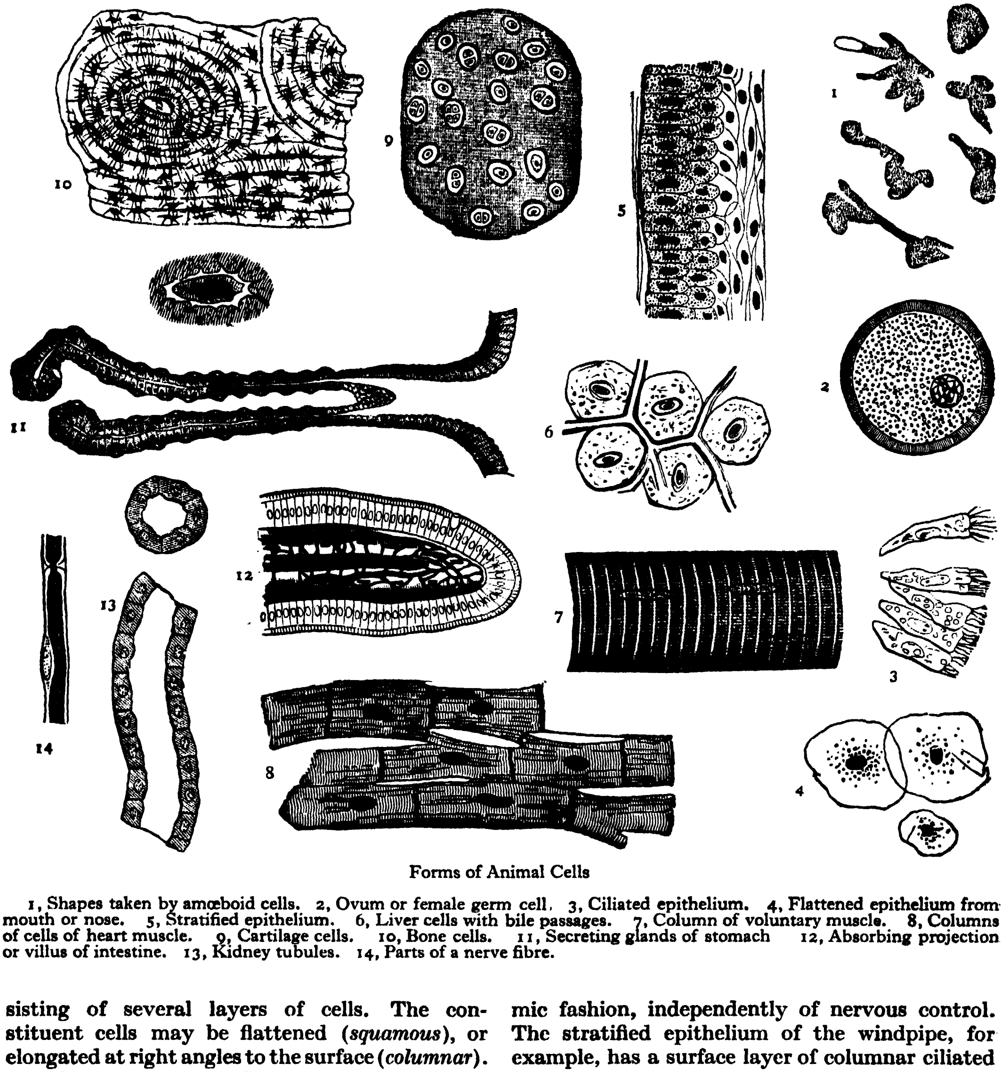
S, Spiral vessel. A, Annular vessel. P, Pitted vessel. F, Fibres in the wood of a fibro-vascular bundle.



Sieve-tube, showing sieve-plate. Pl.

Animal Histology.—The vast majority of animal cells are devoid of definite external walls, and when these do occur, they are not composed of cellulose. *Intercellular substance* is present between the component cells of a tissue, and the term *matrix* is applied to this when it is relatively abundant. In some tissues, cells are associated with fibres and other cell products. As might be expected from their relative complexity, animals are possessed of certain tissues which are either absent from higher plants, or at most faintly represented, as in the case of muscular, nervous, and sensory structures. The following summary account sets forth a selection of the more important facts. A. *Embryonic tissue.* The embryo of a vertebrate animal is made up of three actively dividing *germinal layers*, very broadly comparable to the primary meristem of a higher plant. The external layer, *epiblast* (ectoderm), gives rise to the epidermis, lining of the mouth cavity, nervous system, retina and lens of the eye. From the innermost layer, *hypoblast* (endoderm), are produced the cells lining the greater part of the digestive tube and its outgrowths, and also the *notochord*, an elastic longitudinal rod situated below the central nervous system, and commonly partly or entirely replaced by the backbone. From the middle layer, *mesoblast* (mesoderm), arise all the other parts of the body. B. *Permanent tissues.* (1) *Blood and lymph.* These are tissues in which the constituent cells, *corpuscles*, float freely in a liquid matrix. These corpuscles are either white or red. The former are typical cells, of irregular shape and capable of executing creeping movements; also of engulfing and digesting intruding bacteria and other noxious germs. Their average diameter, in man, is $\frac{1}{2500}$ inch. The *red corpuscles* of mammals are non-nucleated biconcave discs, nearly always circular in shape. Those of man are about $\frac{1}{3200}$ inch. in diameter.

The red corpuscles of other vertebrates are oval, nucleated, and of larger size, especially in Amphibia. *Lymph* resembles blood, except in the absence of red corpuscles. (2) *Epithelium*, layers of cells covering the exterior of the body and lining the internal cavities. It is *simple* when only one cell thick, *stratified* when consisting of several layers of cells. The constituent cells may be flattened (*squamous*), or elongated at right angles to the surface (*columnar*). *Simple squamous epithelium* lines the heart and blood-vessels, and *simple columnar epithelium* lines the greater part of the digestive tube. *Stratified squamous epithelium* lines the mouth cavity and constitutes the *epidermis*, or outer layer of the skin. *Glandular epithelium* makes up the essential parts of the tubules composing glands, such as liver, pancreas, salivary glands, and kidneys. Its cells are granular and cubical or polyhedral. In the case of certain internal tubes, the epithelial lining is *ciliated*, i.e. the cells adjoining the cavity are provided with innumerable short protoplasmic threads, *cilia*, which alternately bend and straighten in rhythmic fashion, independently of nervous control. The stratified epithelium of the windpipe, for example, has a surface layer of columnar ciliated cells, of which the cilia work in such a way as to move particles of dust, bacteria, &c., towards the exterior. Slender *sense cells* are the most important part of the epithelium of sense organs, and they differ in character according to the stimuli by which they are affected. *Germinal epithelium*, producing sexual cells (ova and



Forms of Animal Cells

1, Shapes taken by amœboid cells. 2, Ovum or female germ cell. 3, Ciliated epithelium. 4, Flattened epithelium from mouth or nose. 5, Stratified epithelium. 6, Liver cells with bile passages. 7, Column of voluntary muscle. 8, Columns of cells of heart muscle. 9, Cartilage cells. 10, Bone cells. 11, Secreting glands of stomach 12, Absorbing projection or villus of intestine. 13, Kidney tubules. 14, Parts of a nerve fibre.

spermatozoa), makes up the essential parts of the generative glands (ovary and testis). (3) *Supporting tissues* include connective tissue, cartilage, bone; dentine and enamel. (*a*) *Connective tissue* is made up of branching cells and delicate fibres. In *white connective tissue* these fibres are exceedingly narrow, unbranched, inelastic, and arranged in wavy bundles, as, for example, in tendons. *Yellow connective tissue* contains branching, elastic fibres of rather larger size, and is found in parts of the body where elasticity is necessary, e.g. the lungs and arteries. *Areolar connective tissue* contains both white and yellow fibres. It occurs below the skin, between bundles of muscle, &c. (*b*) *Cartilage* or *gristle* consists of cells embedded in a tough translucent matrix, which may be traversed by fibres (fibro-cartilage). (*c*) *Bone* contains branching cells embedded in an organic matrix which is strengthened by the deposit of salts of lime (carbonate and phosphate). It may be spongy or compact, as in the ends and shaft, respectively, of a long bone. In compact bone, blood-vessels and nerves are contained in narrow tubes (Haversian canals), round which the bone cells are disposed in concentric *Haversian systems*. Each cell occupies a corresponding chink (lacuna) in the hard matrix, and its processes are contained in exceedingly small passages (canaliculi) which radiate from this. (*d*) *Dentine* and *enamel* are hard substances making up the greater part of teeth. The former, also known as *ivory*, surrounds the pulp cavity, and consists of wavy tubules. Still harder *enamel*, composed of microscopic prisms, covers the projecting crown. The fangs of the tooth are invested by a thin layer of *cement*, which is to be regarded as bone. (4) *Muscle* is of three kinds. (*a*) *Unstriated*, composed of spindle-shaped cells, which are not marked by transverse striations. It is found in the walls of arteries, veins, and hollow internal organs. (*b*) *Cardiac muscle* makes up the wall of the heart. It consists of cylindrical cells united together into a complex network, and marked by transverse striations. (*c*) *Striated muscle* constitutes the flesh, by which voluntary movements are effected. Its constituent fibres are formed by the fusion and specialization of rows of cells. Each fibre is transversely and longitudinally striated, and invested by a delicate sheath (sarcolemma), under which are nuclei, which indicate the origin of the fibre as a cell fusion. Various theories have been advanced to explain transverse striation, but none are entirely satisfactory. It is associated, however, with the power of rapid and vigorous contraction, i.e. shortening and broadening without change in volume. (5) *Nerve*. The nervous system is essentially composed of greatly specialized cells known as *neurons*, which are not connected together as formerly supposed. A typical neuron consists of a nucleated swelling, *cyton* (often called a nerve-cell), with one or more branching processes, *dendrons*, and a single rather larger process, *axon*, continued to form the central conducting thread (axis cylinder) of a nerve fibre. Nerve impulses pass inwards along the dendrons, and outwards along the axon. The so-called *grey matter* of brain and spinal cord chiefly consists of cytons, which are also present in outlying nervous centres known as *ganglia*. The *white matter* of the organs named is mostly made up of axons. Nerve fibres are of two kinds, non-medullated and medullated. The former consist of an axis cylinder covered by a delicate membrane, the *neurilemma* (primitive sheath), beneath which nuclei are present at intervals. Such fibres are characteristic of the sympathetic nervous systems, and also make up the olfactory nerve. In medullated nerve-fibres there is a layer of fat (medullary sheath) between the axis cylinder and neurilemma, and each fibre is divided into a number of segments, between which the neurilemma dips inwards to touch the axis cylinder. All the spinal and cranial nerves (except the olfactory) are made up of such fibres.—BIBLIOGRAPHY: (1) Plant Histology: F. Cavers, *Practical Botany*; Flatters, *Vegetable Histology*; Chamberlain, *Methods in Plant Histology*. (2) Animal Histology: Sir E. A. Schäfer, *Essentials of Histology*; C. Hill, *Manual of Normal Histology*; Jordan and Ferguson, *Textbook of Histology*; R. Krause, *Course in Normal Histology*; Arey, *Laboratory Guide in Histology*; A. Bolles Lee, *Microtomist's Vade Mecum*.

History in its widest sense relates to the whole past of mankind and to the natural and physical conditions which have influenced human life. Thus geology may be regarded as a part of history, because it deals with the development of the physical construction of the globe, i.e. with conditions which have determined much of the action of mankind. Such an extension of its meaning would obviously deprive the study of any distinctive significance, and history proper is concerned primarily with the acts and the thoughts of human beings. It has been urged that "History is, above everything else, geography", but such a view gives undue emphasis to the admitted importance of geography in relation to historical investigation. Geography is the term employed to indicate one series of conditions with which mankind has had to deal; it explains many human activities, but these activities themselves are the interests of the historian. Part of the story of mankind is the record of the triumph of human invention over geographical obstacles, and it may be said that the development of methods of communication and transport constitutes a practical modification of geography. Freeman's saying, "History is past politics, and politics is present history", is valuable because of the stress it lays upon the essential element of human action in relation to the physical and other conditions which influence the life of mankind, but it is insufficient as a definition. The province of history, in the ordinary sense in which the term is used, is restricted not only by the circumstance that its main topic is the record of human action, but also by the nature of the materials which provide that record. It has to be distinguished from anthropology, which is mainly concerned with the customs of savage life and their survival in ancient or modern civilized societies. The border-line between anthropology and history cannot be drawn very accurately, but, as a rough indication, we may take the existence of written documents as a test of historical material. The historian is mainly occupied with written records (whether on stone, parchment, or paper), and his business is to discover from written records the facts about the past of mankind, to interpret and explain them, and to present them in literary form.

There has been, in recent years, considerable controversy about the methods and aim of history, and about its connection alike with ethics and with literature. The older tradition of historical writing involved great care about literary form, and the mode of presentation was regarded as the test of the author's achievement, while the older writers also were given to moralizing upon the characters they drew and the events they narrated. The task of producing a graceful narrative has been rendered much more difficult by the opening up of national and family archives, and the consequent multiplication of historical sources. The ascertainment of fact and the examination of conflicting evidence has become the primary duty of the historian, and it is very difficult to present the process and the results of an elaborate investigation in a form which deserves the term 'literary'. Hence there has arisen a school of historians who hold that history is a science and not an art; that it is not a branch of literature, but a branch of science, dealing with man under political and social and economic conditions, in the same manner as other sciences deal with man under biological or physiological conditions. On this theory, the business of the historian is to collect and classify facts and to explain their meaning, and he is not called upon to attempt the work of a literary artist, to excite the imagination or the emotions. There is, however, a reaction against the scientific school, and other authorities argue that the historian must not merely accumulate and interpret facts, but must also provide "the exposition of these facts in their full emotional and intellectual value to a wide public by the difficult art of literature". The choice between these different points of view depends, in part, upon the qualifications of the writer and upon the nature of his subject, for not every historical investigation is capable of being made attractive to a wide public in literary form, but there can be little question about the ideal at which the historian should aim. The prejudice against the literary and artistic presentation of the results of historical investigation is ceasing to exist, and the older models are exercising a growing influence.

On the other hand, there is no such reaction against the divorce of history from ethics. It is admitted that history cannot formulate general laws or establish universal relationships of cause and effect, because history never repeats itself, and no two historical 'events' are precisely similar; each is a set of circumstances, and there are numberless variations in the circumstances. This fact not only militates against the conception of history as a science; it also restricts the tendency to treat the subject as a storehouse of moral lessons. The late Lord Acton, indeed, exhorted his Cambridge students "never to debase the moral currency or to lower the standard of rectitude, but to try others by the final maxim that governs your own lives, and to suffer no man and no cause to escape the undying penalty which history has the power to inflict on wrong". But the general tendency of modern writers is to leave the reader to form his own moral judgment, and, except in the clearest cases, to refrain from pronouncing sentence. Indeed, the ideal of impartiality has been carried so far that it has been argued that modern historiography encourages "the idea that all sides in the quarrels of the past were equally right and equally wrong". This is an exaggeration of the reaction against the use of history as a political or ecclesiastical pamphlet, and it may be carried too far. It is the duty of an historian to state his facts accurately and in their proper proportion; if he does so, a statement of his individual opinion, clearly expressed as opinion and not disguised as historical doctrine, will be helpful to the reader whether he differs from the author or not. The real test of impartiality lies rather in the selection of the facts presented to the reader and in the discrimination between what is definitely ascertained and what is conjectural, than in the employment of adjectives or the expression of personal opinions.

History, it may be said, is, in the first place, the discovery and the examination of sources of evidence, and the determination of the value of conflicting records, and, in the second place, the presentation of the results of this investigation in literary form in a manner which will arouse both the emotional and intellectual interest of the reader and lead him to apply his information to the problems of his own time. No such problem can be solved by mere reference to historical parallels or precedents, but a knowledge of the past " can mould the mind into the capability of understanding great affairs "; it can help to remove current prejudices and to place the essential features of modern difficulties in a new perspective, to widen the outlook, and to create new ideals and enthusiasms.

History is usually divided into three compartments, ancient, mediæval, and modern. Such distinctions are useful as a convenient method of arrangement, and as emphasizing the effects of certain very great events, though the very existence of dividing lines is apt to create a misapprehension and to obscure the continuity of human history. Ancient history covers the history of the world up to the fall of the Roman Empire. It includes the records of the Hebrew, Arabian, Phœnician, Egyptian, and other races, as well as the history of Greece and Rome, but for the ordinary reader, who has no knowledge of Eastern languages, the subject tends to mean Greek and Roman history and the history of the Jews. The two earliest centres of recorded human civilization were Babylonia and Egypt, and for the long period of over 2000 years (*c.* 5000–2500 B.C.) ancient history is the story of the independent development of these two countries, each of which produced a remarkable civilization. The next stage is the expansion of Babylonia, which, under the rule of Hammurabi (*c.* 2250 B.C.), founded an Empire that lasted until about 1600 B.C., when it fell, largely owing to the growth of the new Assyrian power in the North. For about 500 years after that date, the Egyptian Empire was the great World Power, and it exercised dominion over Syria. From about 1100 to 900 B.C., when the power of Egypt had declined, we have the rise of independent kingdoms in Syria—Tyre in the north, the Philistines in the south, and the Israelites in the south-east. The Kingdom of Israel reached the height of its greatness in the reign of Solomon (*c.* 1015–977 B.C.). Then for nearly three hundred years (*c.* 900–600 B.C.) the Assyrian Empire was the ruler of the world, its greatest period being the reign of Sennacherib (705 – 681 B.C.). It collapsed from internal weakness and from the attack of the Medes, and the very site of its great capital, Nineveh, was long unknown. Its place was taken by two powers, the Chaldeans or Babylonians under Nebuchadnezzar, and the Medes, who, about 550 B.C., were conquered by the Persians under Cyrus. He subsequently reduced the Babylonians to subjection and formed the Persian World-Empire, which lasted for half a century, under Cyrus, Cambyses, and Darius. The Persian Empire came into conflict with the Greeks, and the victory of the Greeks shifted the centre of civilization from the East into Europe. Greek history begins not later than 1000 B.C.; but it is not until about 700 B.C. that much is known about it, and its greatness followed the Persian Wars and the battles of Marathon and Salamis (490 and 480 B.C.). The result was the development of a series of Greek Empires—Athenian, Spartan, Theban, and Macedonian, which occupy the historical stage until the death of Alexander the Great in 323 B.C. The division of his Empire after his death prepared the way for the emergence of the Roman power. The early centuries of Roman history are occupied with the rise of the city and the extension of its authority over the Italian Peninsula. When this task was accomplished, in the end of the third century B.C., Rome became involved in a struggle with the African power which had arisen at Carthage, and its victory was followed by the establishment of a Roman Empire in the East (200 B.C.–44 B.C.), and by the creation of a World-Empire, which coincides with the end of the Roman Republic and the institution of the Principate or Empire under Augustus and his successors.

Mediæval history begins with the fall of the Roman Empire. A more suitable date has been suggested in the reign of Constantine (A.D. 324–337), which marks the transference of the seat of Empire from Rome to Byzantium or Constantinople, and the reconciliation of the Empire with the growing power of the Christian religion, but the general usage is to place the end of ancient history about the year 476, which marks the end of the existence of the Roman Empire in the West. It had been revived after the death of the Emperor Theodosius in 395, when there was a permanent division into the Eastern and Western Empires, and for nearly a century had carried on an ineffectual resistance against the hordes of barbarians, Goths and Vandals, who swept down upon Western Europe and destroyed the civilization of the Empire. It is this destruction of the institutions which had been built up by the political genius of the Romans that creates a definite dividing-line between the ancient and the mediæval world. The process was gradual, and in many ways the year 476 has no special significance, for there are later traces in Italy of the recognition of the Imperial power as represented by the Eastern Empire, but it affords a convenient label for the end of Roman, and the rise of German, influence in Europe. The centuries which are called ' mediæval ' are subdivided into the ' Dark Ages ' and the

'Middle Ages' proper. The name of the Dark Ages is given to the confused history of the sixth, seventh, eighth, and ninth centuries, in the course of which the barbarian tribes made their settlements in Western Europe, were converted to Christianity, and developed into the great European countries of mediæval and modern times. The most important event of the period was the restoration of the Roman Empire by Charlemagne, King of the Franks, in 800 A.D., but after his death the territories which he had united were partitioned under his successors. The history of the Dark Ages also includes the rise of the Papal power in Italy and throughout the greater part of Europe, the origin and development of the great religious system of Mahomet, and the external and internal conflicts of the Eastern Empire which maintained its existence at Constantinople. The Middle Ages (q.v.) proper may be said to begin with the second restoration of the Roman Empire by Otto the Great in 962, and a large portion of their history relates the struggle between the revived Empire and the Papacy, which distracted Italy and Germany for about two centuries, and culminated in the fall of the Imperial House of Hohenstaufen and an interregnum in the Empire (1250–1273). This struggle was succeeded, in the fourteenth century, by the Great Schism in the Papacy and by the period of the great Church Councils at Pisa (1409), Constance (1414), and Basel (1431), which attempted to bring peace and unity into the Church and the Empire. In England, the Middle Ages witnessed the consolidation of the kingdom under the strong dynasty founded by William the Conqueror; the origin and growth of a parliamentary system; the attempts at the expansion of English power in Ireland, Wales, Scotland, and France; and the civil war between the Houses of Lancaster and York which followed the expulsion of the English from France. The history of France is the story of the gradual growth of the power of the monarchy, which was interrupted by the English invasion, but ultimately received a great impetus from its failure. All over Europe, society in the Middle Ages was deeply affected by the long series of Crusades in the Holy Land, and by the intellectual and religious movements which led to the foundation of universities and the establishment of the various orders of Friars. The Eastern Empire maintained until 1453 an unequal struggle against the growing power of the Turks, who, in that year, captured Constantinople.

The capture of Constantinople is sometimes taken as the beginning of modern, as distinguished from mediæval, history. The transition is marked by the rise of new intellectual interests, known as the Renaissance or Revival of Learning, by the revolutions in geographical conceptions and in trade routes brought about by the discovery of the New World, and by the inauguration of a new era of national conflicts, inspired by dynastic ambitions. The year 1453 marks only the early stages of this transition, and other dates are also employed. In England, 1485, the year of the battle of Bosworth, is usually taken as the end of one era and the beginning of another, and for Europe generally, historians often regard the expedition of Charles VIII of France into Italy in 1494 as the beginning of modern history. Just at the close of the mediæval period, a new Great Power had been created by the union of Spain under Ferdinand and Isabella in 1479, and the first years of the modern period were marked by the rivalry of France and Spain, the power of which was greatly increased by a marriage alliance with the Imperial House of Habsburg. National rivalries were interrupted by the Reformation, which caused internal divisions in every European country, and brought about the Wars of Religion in which the combatants were influenced rather by religious than by national sympathies. This period ended with the close of the Thirty Years' War in Germany and of the great Civil War in Britain in the middle of the seventeenth century, and a fresh series of conflicts was brought about by commercial jealousies, by the attempt of France to attain supremacy in Europe, and by the rivalry of Great Britain and France in India and North America. A marked dividing-line in modern history is given by the French Revolution of 1789, and it may be argued that we should cease to describe the period from 1494 to 1789 as 'modern', and reserve that name for the era inaugurated by the Revolution, to which and to the wars which followed it may be traced the origins of the great events of the nineteenth century—the national developments in Italy and Germany, the disruption of the Ottoman Empire, and the causes of the great European War of 1914–8. Until the year 1783, the history of the New World can be studied only in relation to the Old, but from the establishment of the United States the American continent has its own independent history. The history of Africa, of many parts of Asia, and of Australia cannot be separated from the history of the European Powers, although China has its own independent story, and the rise of Japan is one of the most important aspects of world-history in recent years.

Apart from this chronological division, history is also distinguished according to topics. The history, for example, of the Christian Church, of law and institutions, of war, of trade and commerce are all part of the general matter of history, but are capable of independent treatment throughout the whole range of our knowledge. Biography is also closely allied with history, and one of the best methods of understanding a period is to study the lives of its most illustrious men. In recent years, the study of local history has formed an excellent avenue to the wider study of general history, to which it has also made valuable contributions. Among the great historical publications in recent years are: Lavisse and Rambaud's *Histoire générale*; *The Cambridge Modern History*; Dr. Williams's *Historian's History of the World*; Oncken's *Allgemeine Geschichte*; &c.—BIBLIOGRAPHY: Langlois, *Manuel de bibliographie historique*; Lord Acton, *Lecture on the Study of History*; F. Harrison, *The Meaning of History*; Langlois and Seignobos, *Introduction aux études historiques*; C. W. Smith, *Lectures on the Study of History*; E. A. Freeman, *Methods of Historical Study*.

Hitchcock, Edward, American geologist, born 1793, died 1864. After being for four years minister of a Congregational church at Conway, Massachusetts, he was appointed in 1825 professor of chemistry and natural history at Amherst College, and in 1845 president of the same college, and professor of natural theology and geology. He was connected with the State survey of Massachusetts, Vermont, and part of New York, valuable reports on which he published. He was author of various other works, including: *Geology of the Connecticut Valley*; a highly popular work on *Elementary Geology*; *Illustrations of Surface Geology*; *Religion of Geology and its Connected Sciences*; and *Reminiscences*, published shortly before his death.

Hitchin, a market town of England, in the north of Hertfordshire, in Hitchin parliamentary division. The parish church contains some fine old brasses and a fine altar-piece by Rubens, and there is a grammar-school. Straw-plaiting is carried on, and lavender and peppermint are grown and distilled. Girton College was originally established at Hitchin in 1869, but removed to Cambridge in 1872. Pop. 13,535.

Hitopadesa (hit-ō-pa-dā′sha; Skt., goodly instruction), an ancient Sanskrit work by an author named Narayana. It is similar to and mostly taken from an older work called the *Panchatantra* or the five books, the source also of the collection known as the *Fables of Bidpai or Pilpay*. The book consists of fables, one story growing out of another after the Eastern fashion, with verses cited from ancient writers by the interlocutors, and was designed for the instruction of princes. It has been translated into many Asiatic and European languages.

Hittites, the Biblical name given to the people (called Kheta on the ancient Egyptian monuments, and Hatti by the Assyrians) whose powerful empire extended from Northern Asia Minor (east of the Halys River) south as far as Hamath in Syria, or even Hebron in South Palestine, where Abraham is reported to have bought from them the cave of Machpelah as a burial-place for Sarah (*Gen.* xxiii). The first reference to them is in *Gen.* x, 15, where we are told that Canaan begat Sidon, his first-born, and Heth. This suggests that the sons of Heth were in Syria in 2100 B.C.; but we know that they were a powerful empire, able to stand up against the mighty Mesopotamian and Egyptian powers for many centuries. It was not until 717 B.C., when the Assyrians took Carchemish, the southern capital of the Hittites, that their empire was broken. Their chief capital was in the north at Boghaz-keui in Cappadocia. Little progress has yet been made in the interpretation of the hieroglyphic writings of the Hittites, but at present the language is supposed to belong neither to the Indo-European nor to the Semitic groups. Recent research, especially excavations in Carchemish and Boghaz-keui, has revealed something of the great part played by the Hittites in the early history of civilization.—BIBLIOGRAPHY: A. H. Sayce, *The Hittites: the Story of a Forgotten Empire*; J. Garstang, *The Land of the Hittites*; A. E. Cowley, *The Hittites*, (Schweich Lectures, 1920).

Hitu′. See *Itu*.

Hi′vites (' snake clan ', or ' dwellers in encampments '), a Canaanitish tribe first noticed in *Gen.* xxxiv. At the conquest of Canaan the main body occupied the northern confines of Western Palestine. Solomon subjected them to a regular tribute. Gibeon and Shechem were their chief cities.

Hoadly, Benjamin, English prelate, born 1676, died 1761. He was educated at Cambridge; took orders in 1700, and, after being settled in London, distinguished himself in controversy with Bishop Atterbury and others. A staunch Low-Churchman, he was appointed Bishop of Bangor in 1715. A sermon, on ' The Kingdom of Christ ', preached before the king in 1717 gave rise to the ' Bangorian Controversy' (q.v.) regarding the divine authority of the king and the Church. He was translated to the see of Hereford in 1721, to Salisbury in 1723, and Winchester in 1734.—Cf. Sir L. Stephen, *History of English Thought in the Eighteenth Century*.

Hoang-Ho, or **Yellow River**, a large river in China, the sources of which are in mountains in the Koko-Nor territory, north from Tibet. After a winding course of several hundred miles, it proceeds nearly due north to about lat. 41°; then east for nearly 200 miles, when it suddenly bends round, and flows directly south for about another 200 miles; then turns abruptly east, and flows in that direction till it reaches Lung-menkau, when it diverges to the north-east, and falls into the Gulf of Pe-che-le about lat. 37° 30′, and long. 118° 30′. From the thirteenth century till 1852 the Hoang-Ho entered the sea in lat. 34°, south of the Peninsula of Shan-tung, but at the latter date it took its present course. Since then vast sums have been spent in watching and strengthening the banks of the river, which is constantly overflowing at some point. In the autumn of 1887 the whole body of the river burst its banks about 300 miles from its mouth, and flooded about one-sixth of the province of Ho-nan, destroying towns and villages and causing a loss of life the lowest estimate of which is one million. Its length is estimated at about 2600 miles. It derives its name from the vast quantities of yellow earth held in a state of solution by its waters.

Hoatzin, or **Hoactzin**, *Opisthocŏmus cristātus*, a singular gregarious South American bird, is the sole representative of a distinct sub-order (Opisthocomi) of gallinaceous birds. The plumage is brown streaked with white, and the head has a movable crest. It is of the size of a pheasant, and has an enormous crop with a very small gizzard. The powers of flight are limited, and there is an area of hardened skin on the under side of the body, on which it is accustomed to rest. The precocious young climb actively about with the aid of two claws on each wing; they can also swim and dive.

Hobart, up to 1881 **Hobart Town**, the capital of Tasmania, situated at the foot of Mount Wellington (4166 feet), on the River Derwent, about 12 miles from its mouth. The city, founded in 1804, is built in the form of a square, the streets crossing each other at right angles. Among the public buildings are the Government house, the Government offices, the Houses of Parliament, town hall, university, museum, Episcopal and Roman Catholic cathedrals, and several other places of worship, many public and private schools, and the general hospital. There are several jam manufactories, breweries, flour-mills, tanneries, and a woollen factory; and in connection with the shipping interest first-class patent slips. The harbour is easy of access, and has ample depth, capacity, wharf and dock accommodation. Hobart is connected by rail with Launceston. Pop. 50,000.

Hob′bema, Meindert or Minderhout, after Ruysdael the greatest Dutch landscape-painter, born at Amsterdam in 1638, died 1709. He died in poverty, but few facts of his life are known. His paintings consist chiefly of forest scenes, ruins, villages, or water-mills. With Jacob van Ruysdael he stands at the head of the seventeenth century Dutch landscape school. Less imaginative than Ruysdael's, his work shows the same intimate knowledge of nature and feeling for space and atmosphere. His colour is apt to be heavy and sombre: and at times he loses breadth by over-emphasis of detail. He considerably influenced the English landscape painters, notably Crome and Constable. *The Avenue of Middelharnis*, *Showery Weather*, *Ruins of Breberode Castle*, &c., are in the National Gallery. There are also paintings by him in the Wallace Collection, in Buckingham Palace, and in the Fitzwilliam Museum, Cambridge.

Hobbes, Thomas, English moral and political philosopher, born 1588 at Malmesbury, died 1679. Educated at Magdalen Hall, Oxford, he afterwards travelled on the Continent as tutor in the Earl of Devonshire's family, becoming acquainted with Gassendi, Descartes, and Galileo. He was also intimate with Bacon (some of whose works he translated into Latin), Lord Herbert of Cherbury, and Ben Jonson. From 1637 to 1641 he resided much at Chatsworth, but becoming alarmed at the likelihood of an outbreak of civil war, he went to Paris. He stayed abroad some years, and during that time published most of his works. Hobbes also taught mathematics to the Prince of Wales (Charles II), then in Paris, who after the Restoration gave him a pension of £100. He spent his latter days with the Devonshire family. The most remarkable of his works is his *Leviathan, or The Matter, Form, and Power of a Commonwealth* (1651). Other works are: *De Cive* (1642); *De Corpore Politico* (1650); *De Libertate, Necessitate, et Casu* (1654); and *Behemoth*, a history of the Civil War, published after his death. He also published a metrical version of the *Iliad* and *Odyssey*. In the history of the development of free-thought in Europe Hobbes holds an important place, and he was one of the first great English writers on government. Hobbes was above all a political philosopher, and would have the State supreme in all matters affecting the mutual relations of men. He conceived the state of nature to be one in which all are at war with one another, and government as the result of a compact, suggested by selfishness, for the sake of peace and protection. Absolute rule was the best form of government, but this is qualified by the assertion that obedience to a ruler is only due so long as he can afford protection to the subject. A sensationalist and at times a materialist in philosophy and psychology, Hobbes was hedonistic in his ethics. It was man's desire for pleasure that made him, according to Hobbes, first establish civil authority. Hobbes made religion also a political matter, and defined it as fear of power invisible, feigned by the mind or imagined from tales publicly allowed. The philosophy of Hobbes, so depreciated among his contemporaries, has been more or less adopted by Locke, Hartley, Hume, and Priestley, and his ideas on government have formed the foundation of the utilitarianism of the Benthamites.—Bibliography: Sir Leslie Stephen, *Hobbes*; G. Croom Robertson, *Hobbes*; E. H. Sneath, *The Ethics of Hobbes*; M. W. Calkins, *The Metaphysical System of Hobbes*.

Ho'boken, a city, New Jersey, United States, on the Hudson River, and close to Jersey City, which stretches immediately to the south. It lies opposite New York, with which it is connected by tunnels and ferries. It has various manufactories, and among the public institutions are the Stevens' Institute of Technology and the public library. Pop. 68,166.

Hoche (ōsh), Lazare, general in the French revolutionary war, born 1768, died suddenly in Sept., 1797. At the age of sixteen he took service in the French guards, and at the Revolution joined the popular party. He greatly distinguished himself at the siege of Thionville and the defence of Dunkirk, and shortly afterwards, when scarcely twenty-five years of age, received the command of the Army of the Moselle. In 1793 he drove the Austrians out of Alsace, and soon after was arrested by the Jacobins and imprisoned at Paris. In 1794 he was released, and appointed commander of the army detailed to quell the rising in the west, and afterwards to that in La Vendée. In 1796 he conceived the plan of attacking Britain, by making a descent on Ireland. He accordingly set sail in December from Brest, but the expedition failed utterly, and he was obliged to return without having even effected a landing. After his return he received the command of the Army of the Sambre and Meuse. He opened the campaign of 1797 by a bold passage over the Rhine, and had defeated the Austrians in several engagements, when he was stopped in the path of victory by the news of the armistice concluded in Italy. He died shortly afterwards. —Cf. A. Griffith, *French Revolutionary Generals*.

Hochheim (hō*h*'hīm), a town of Prussia, in the province of Hesse-Nassau, 4 miles E.N.E. of Mayence. It is famous for its wine, called in Germany *Hochheimer*, English *Hock*. Pop. 3480.

Hochkirch (hō*h*'kir*h*), or **Hochkirchen**, a village in Saxony, 6 miles E.S.E. of Bautzen, the scene of the surprise and defeat of Frederick the Great, in 1758, by the Austrians under Marshal Daun, in which Marshal Keith was killed; and also of a defeat of the Russians and Prussians by the French in 1813. Pop. 500.

Höchstädt (h*euh*'stet), a town, Bavaria, left bank of the Danube, 23 miles N.W. of Augsburg, the scene of several great battles, of which the most celebrated is that of Blenheim in 1704. (See *Blenheim*.) Pop. 2500.

Hock. See *Wines*; *Hochheim*.

Hockey, a ball game, the name of which is probably derived from the hooked stick employed. It is cognate to the Scottish *shinty*, and to the Irish *hurley*, and is known in certain circles as *bandy*. It is of considerable antiquity, and appears to have been played by the Romans.

Whilst in general popularity it cannot rival either code of football in this country, hockey possesses certain advantages which make a very strong appeal. Deprived of many of the dangers inseparably associated with football, it is still sufficiently strenuous to appeal to the most athletic, and yet afford opportunities to the less vigorous who still desire to participate in match play. It is popular in girls' schools, and mixed hockey matches are also arranged, although not as a serious competition. On the whole it is not popular with the authorities of public schools, probably because of the desire to preserve a more whole-hearted allegiance to football as the winter game *par excellence*. Nor have the Continental nations taken to it with enthusiasm, although international matches between France and England have been occasionally played.

In its rules and in the constitution of teams hockey bears a very close resemblance to Association football. Eleven a side comprise a goalkeeper, two backs, three half-backs, and five forwards. The ball employed is of leather, white or painted white; usually a painted cricket-ball is used.

The sticks must not exceed 28 oz. in weight, and must be of such size as to pass through a 2-inch ring. They are slightly curved at one extremity, and flattened on the left-hand surface.

The ground for play is rectangular, 100 yards long and 60 yards in width, with boundaries marked by chalk-lines, and flags at the corners. The boundaries are known as goal-lines and side-lines. The goals (in the centre of each goal-line) are two posts 4 yards apart joined by a crossbar 7 feet from the ground. In front of the goal is drawn 'the striking circle'—a semicircle, having the goal-line as a diameter and with a radius of 15 yards.

The game is started by the 'bully off', as it is called. The centre-forwards of the respective teams face each other with the ball between them, and each strikes the ground with his stick on his own side of the ball and his opponent's stick three times alternately, after which the ball itself may be struck.

A goal is scored by the ball being hit through the goal by a player whilst within the striking circle. The off-side rule applies exactly as in Association football, viz. a player is 'off-side' if he is nearest the opponent's goal at the moment when the ball is hit or rolled in from touch (the side-lines) unless there are at least three of his opponents nearer their own goal than he is.

The ball may be caught by the hand, but must be immediately dropped, that is to say, it may not be picked up, carried, or thrown, nor may the ball be actually kicked, although it may be stopped by the foot. Only the flat side of the stick may be used for striking the ball; using the other side constitutes a foul with a penalty attaching thereto. An opponent's progress may be stayed by hooking his stick, but only if the stick is within striking distance of the ball. Further, if a player strikes at the ball, no part of the stick must rise above his shoulders throughout the stroke. Disregard of this rule is penalized (as in the case of other fouls) by the award of a free hit to the other side.

As has been stated, the general principles of the game are exactly those of Association football, with a roll in from touch whenever the ball crosses the side-lines, and a corner hit allowed to a side if an opposing player hits the ball behind his own goal-line. Play is usually for two periods of thirty-five minutes, with a short interval during which ends are changed.

Hockey is an exceedingly popular game in the London suburbs, and prominent teams which may be mentioned are Surbiton, Finchley, Hampstead, Wimbledon, Southgate, and Beckenham. Most of the London hospitals have teams, and the same applies to the colleges at Oxford and Cambridge. So high is the standard of hockey regarded that Cambridge has since 1907 awarded a full Blue to the representatives selected to meet the Oxford eleven, thus classing the game with rowing, football, cricket, track athletics, and tennis (not lawn tennis). The members of the Oxford team are awarded half Blues.

County matches lead by gradual selection to the international matches, the first of which was played in 1895 (Oxford had competed with Cambridge first in 1890). Ladies' inter-county and international contests also take place. The Hockey Association, which is responsible for the rules and organization of the game, was founded in 1875.

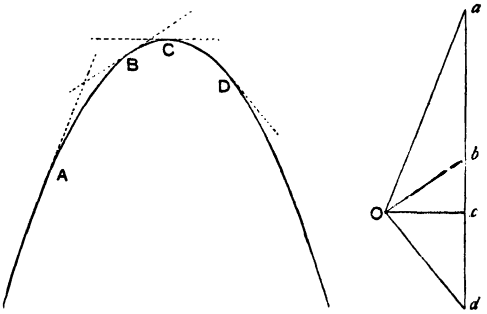
The skill and combination of first-class players are remarkable. In dribbling the ball and dodging opponents the necessity arises for rapidly changing the position of the stick in order to keep the flat surface in contact with the ball, and a first-class player exhibits greater superiority in this than perhaps in any other game. It is no exaggeration to say that five really good players could with ease beat an eleven of mediocre capability, a claim which would hardly apply to any other game.

Ice-hockey is a game rarely seen in this country owing to the infrequent occasions when skating can be enjoyed. The game requires exceptional experience of skating, and when teams representing Oxford and Cambridge meet at Mürren in December, the majority of the players are Canadians who have had many years experience before coming to study in this country, with a minority of English players who have had exceptional opportunities. The 'ball is a flat piece of wood, and the boundaries ot the field of play are raised platforms of wood about a foot in height, so that the 'ball' rebounds into play. Much skill is possible in utilizing this platform during a dribble. Ice-hockey is probably the fastest and in some respects the most skilful of all games.—Cf. A. Farrel, *How to Play Hockey* (Spalding's Athletic Library).

Hocking, Silas Kitto, British novelist, born 24th March, 1850, at St. Stephen's, in Cornwall. Educated privately, he entered the Wesleyan ministry in 1870, and held several pastorates until 1896, when he retired. His attempts to get into Parliament in 1906 and 1910 failed. His works include: *Alec Green* (1878), *Her Benny* (1879), *Sea Waif* (1882), *Real Grit* (1887), *Where Duty Lies* (1891), *God's Outcast* (1898), *Pioneers* (1905), *The Silent Man* (1906), *Who Shall Judge?* (1910), *The Third Man* (1911), *The Beautiful Alien* (1916), *His Own Accuser* (1917), *Nancy* (1919), and *Watchers in the Dawn* (1920).

Hodeida, a seaport of Yemen, Arabia, on the Red Sea, with an extensive trade in coffee. It was occupied by the British during the European War, and they evacuated the town early in 1921. Pop. 40,000. See *Yemen*.

Hodograph. If from a fixed point O as origin a vector OQ is drawn to represent in magnitude and direction the velocity of a moving point P at any instant, the locus of Q will be a curve which is called the *hodograph* of the motion of P. Here the term curve is to include a straight line as a special case. It is to be noted that the hodograph is not merely a curve, but a curve described by a moving point Q which itself has a velocity at every instant. It is



Hodograph of Projectile

O*a*, O*b*, O*c*, O*d* represent the velocities at A, B, C, D in magnitude and direction.

easily proved that the *acceleration* of the moving point P is fully represented by the velocity of Q at the same instant.

Simple Examples of the Hodograph.—(1) If a particle P is projected vertically upwards or downwards, under gravity, in a vacuum, it is known to have a constant downward acceleration. Hence the hodograph is a vertical straight line, described by the point Q with a uniform downward velocity equal to g, the acceleration of P, and Q is at the origin O at the instant when P is at its highest point, i.e. when its velocity is zero.

(2) An unresisted projectile P under gravity describes a parabolic path. Since in this case also the acceleration of P is constant and vertically downward, the hodograph is exactly the same as in case (1), except that the origin O is no longer in the hodograph, but at a horizontal distance from it which represents the velocity of P when at its highest point.

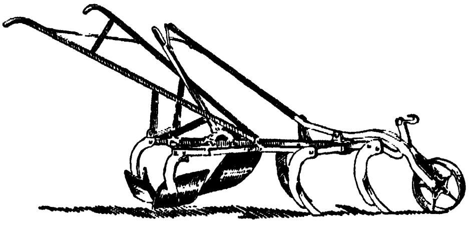
(3) The hodograph of a point P moving with uniform speed V in a circle of radius R is another circle whose radius measures V, the origin being at the centre. The speed of the point Q which describes the hodograph being V^2/R, this is the measure of the acceleration of P.

(4) The hodograph of a point on the rim of a circle which rolls uniformly on a straight line is also a circle uniformly described, but having the origin on its circumference.

(5) The hodograph of the motion of a planet or comet is a circle, which, however, is not uniformly described. The origin in this case is at a distance $e \times$ radius from the centre of hodograph, when e is the eccentricity of the orbit.

The conception of the hodograph and the name are due to Sir William Rowan Hamilton, who applied it to various problems of kinematics.—Bibliography: W. R. Hamilton, Proc. R. Irish Acad., 1846; Kelvin and Tait, *Elements of Natural Philosophy*, pp. 14–17.

Hoe, an instrument for cutting up weeds and loosening the earth in fields and gardens, in shape something like an adze, being a plate of iron, with an eye for a handle, which is set at a convenient angle with the plate. The Dutch hoe differs from the common hand-hoe in having the cutting-blade set like the blade of a spade. A *horse-hoe* is a frame wheel-mounted, and furnished with ranges of shares spaced so as to work in the intervals between the rows of turnips, potatoes, &c. It is used on farms for the same purpose as the hand-hoe.


Horse-hoe

Hof (hōf), a town in Bavaria, Upper Franconia, on the left bank of the Saale, 30 miles N.N.E. of Baireuth. It has woollen, linen, cotton, leather, and paper manufactures. Marble and ironstone are worked in the vicinity. Pop. 41,100.—There is also a town called Hof in Norway, north of Christiania.

Hofer, Andreas, Tyrolese peasant-leader and patriot, born in 1767. In 1796 he led a company of sharp-shooters against the French, and after the Peace of Lunéville took a prominent part in the organization of the Tyrol militia. In 1809 he took the lead in an insurrection of the Tyrolese for shaking off the yoke of Bavaria, to which their country had been transferred by the Treaty of Pressburg. In a short time, with intermittent assistance from the Austrians, he defeated the French and Bavarian troops, and nearly the whole country was liberated. Hofer then carried on the military and civil administration, under the most singular circumstances, till the Peace of Vienna was proclaimed. Misled by false reports, he commenced hostilities anew, and thus forfeited the protection of the amnesty. He remained concealed for some time, but was at last betrayed to the French, and carried to Mantua, where he was tried by a court-martial and shot, 20th Feb., 1810. His family was indemnified for the loss of their property by the Emperor of Austria in 1819, and his son ennobled. There are numerous patriotic songs about Hofer, and he is the hero of tragedies by Auerbach and Immermann.—Cf. K. T. Heigel, *Andreas Hofer*.

Hoffmann, August Heinrich, called also Hoffmann von Fallersleben, German lyric poet and philologist, born at Fallersleben, in Hanover, 1798, died at Corvey 1874. Under the influence of the brothers Grimm he took to investigating old German literature, and became professor of German literature at Breslau in 1835. He also made special studies of Dutch and Silesian literature. Dismissed in 1842 for the supposed revolutionary tendencies of his songs (*Unpolitische Lieder*), he led a wandering life for some years. In 1860 he became librarian to the Duke of Ratibor. He wrote *Horæ Belgicæ*, but he is best known by his songs. One of his most popular songs is his patriotic *Deutschland, Deutschland über Alles*, which he composed on the Island of Heligoland in 1841.

Hoffmann, Ernst Theodor Amadeus, or, properly, Ernst Theodor Wilhelm, German novelist, born at Königsberg 1776, died in 1822. He studied law in his native town, and afterwards held several minor judicial appointments under Government, but intemperate habits ruined his health. He cultivated music and art, especially caricature, with success. Among his works of fiction are the *Phantasiestücke in Callots Manier* (1814), the *Elixiere des Teufels* (1816), the *Nachtstücke* (1817), the *Serapionsbrüder* (twenty-three tales, 1819 *et seq.*), *Lebensansichten des Katers Murr* (1820–2), and many others. In his longer novels he has a strong tendency to make use of supernatural machinery; but his masterpieces are his short stories.

Hofwyl (hof′vil), a village of Switzerland, 6 miles north of Bern, noted as the seat of the educational institution founded by Fellenberg and Pestalozzi in 1802.

Hog. See *Pig.*

Ho′garth, William, painter and satirical artist, born in London 1697, died 1764. He was apprenticed to a silversmith, who employed him in engraving spoons. In 1720 he began business for himself as a designer, and produced designs and book-plates for the booksellers. Among these was a series of illustrations to *Hudibras.* He also painted a number of small genre pieces in oil. In 1729 he married the daughter of Sir James Thornhill, the painter, against her father's wishes, who is said, however, to have been mollified when Hogarth produced his celebrated series of pictures called *The Harlot's Progress*, a work which brought his great powers fairly before the public. The engravings of these, which became exceedingly popular, were published in 1734. This was followed by *The Rake's Progress* and *Marriage à la Mode*, two similar series of paintings and engravings; *Industry and Idleness, Beer Street and Gin Lane, The Election, The Enraged Musician, The Country-Inn Yard, The March to Finchley, Strolling Actresses Dressing in a Barn, Four Stages of Cruelty*, and many other engravings which all evinced his extraordinary powers of satire, wit, and imagination. He also painted a number of masterly and strongly characterized portraits, notably those of himself, Garrick, Lovat, and Wilkes. He was also ambitious of shining as an historical painter, but in this line he was not so successful. In 1753 his work on the *Analysis of Beauty* appeared, a treatise which brought him little fame, and which was severely ridiculed by his enemies and professional rivals. In originality of imagination and invention, and for vigour of realism and dramatic power, Hogarth stands in the highest rank, and his genius was always enlisted on the side of virtue and morality. He is the first and among the greatest of a distinctively English school of painting, marked by literary tendencies, realism, and feeling for colour. He is well represented in the National Gallery, Tate Gallery, and Sir John Soane's Museum. The best edition of his engravings is that published by Boydell (London, 1790), the plates of which, retouched by Heath and others, have been repeatedly published since.—BIBLIOGRAPHY: Samuel Ireland, *Hogarth Illustrated*; W. C. Monkhouse, *Works of William Hogarth*; Austin Dobson, *Hogarth*; Nichols and Steevens, *The Genuine Works of Hogarth*; see also Hind's Great Engravers Series.

Hog-fish, the popular name given to teleostean fishes of the genus Scorpæna, family Scorpænidæ. The best-known species is the *S. scrofa*, common in the Mediterranean, having a spiny laterally-flattened head adorned with membranous lobes or filaments. It is of a large size and a red colour.

Hogg, James, more familiarly known by the name of the *Ettrick Shepherd*, was born in Selkirkshire in 1770, died at Altrive, on the Yarrow, in 1835. After a very scanty education, he began life as a shepherd. His early rhymings, *Donald Macdonald*, in imitation of Burns, and his *Scottish Pastorals*, brought him under the notice of Sir Walter Scott, by whose advice he published a volume of ballads under the title of *The Mountain Bard.* The failure of an ill-judged agricultural scheme brought him to Edinburgh, where he published *The Forest Minstrel* (1810), and started a weekly periodical entitled *The Spy*, which after a short time became defunct. The appearance of *The Queen's Wake* in 1813, with its charming ballad of *Kilmeny*, established Hogg's reputation as a poet. In 1815 he published his *Pilgrims of the Sun*, which was followed by *Mador of the Moor, The Poetic Mirror* (a collection of imitations of living poets), *Queen Hynde*, and *Dramatic Tales*, as well as by *The Brownie of Bodsbeck*, and other prose tales; *The Jacobite Relics* (partly written by Hogg), &c. From 1817 he had held the farm of Altrive from the Duke of Buccleuch at a merely nominal rent; but his farming schemes never thrived, and he was generally in narrow circumstances.—Cf. Mrs. M. G. Garden (Hogg's daughter), *Memorials of James Hogg.*

Hogmanay is used in Northern England and Scotland for the last day of the year and for the New Year's Day gift. The French form is *aguillanneuf*, but the Norman form *hoguinané* is more like the Scottish. Brittany boys used to visit houses at Christmas and knock at doors. When asked who knocked, they answered 'the hoguihanneu'. They were given lard. Another Brittany Christmas custom was for children to cry out '*au guyane*'. They were given lard or beef. The children in Guernsey went round on New Year's Day chanting,

> Oguinâni! Oguinâno!
> Ouvre ta pouque, et pis la recclios.

In Scotland the children on New Year's Eve, or New Year's Morning, attired grotesquely and with faces darkened, went round from house to house to receive their 'hogmanay' (gift), and were called 'guisers' or 'guisarts'. They sang:

> Get up, good wife, and shake your feathers,
> And dinna think that we are beggars;
> For we are bairns come oot to play,
> Get up and gie us oor hogmanay.

Another form of the rhyme is:

> Rise up, good wife, and be no swier
> To deal your bread as long 's you 're here:
> The time will come when you 'll be dead
> And neither want nor meal nor bread.

Hog-plum, the popular name of the plants belonging to the genus Spondias, nat. ord. Anacardiaceæ. Some of the species yield pleasant fruits, as *S. purpurea* and *S. lutea* of the West Indies, the species generally called hog-plum, because their fruit is a common food for hogs.

Hog-rat, a genus (Capromys) of rodent animals, family Octodontidæ, including four species inhabiting Cuba and Jamaica, and related to the cavies. Best known is the hutia (*C. melanurus*), which is rather smaller than a rabbit, and of dark-brown colour with a blackish tail.

Hogshead. See *Weights and Measures.*

Hohenlin'den (hō-en-), a village of Bavaria, 20 miles east of Munich, celebrated for the victory gained by the French under Moreau over the Austrians under the Archduke John, 3rd Dec., 1800.

Hohenlohe (hō'en-lō-e), formerly a principality of Germany, containing 680 sq. miles, now chiefly under Württemberg.

Hohenlohe-Schillingsfürst, Chlodwig Karl Victor, Prince of Hohenlohe-Schillingsfürst, German statesman, born 31st March, 1819, died at Ragatz, Switzerland, 6th July, 1901. He studied political science at the Universities of Heidelberg, Göttingen, and Bonn, entered the diplomatic service, was Bavarian Minister for Foreign Affairs and President of the Council of Ministers, and from 1866–70 assisted Bismarck in bringing about the union of South and North Germany. German Ambassador in Paris in 1874, he represented Germany at the Berlin Congress in 1878. Governor of Alsace-Lorraine from 1885 to 1894, he succeeded Caprivi as Imperial Chancellor, retaining his office till 1900. During his tenure of office he promoted Germany's colonial policy, and did much for the creation of a German navy. Dissatisfied with the ex-Kaiser's aggressive policy, he resigned in Oct., 1900, and was succeeded by Count von Bülow. His *Memoirs*, which caused an international sensation, and incurred the condemnation of the ex-Kaiser, were published in 1906.

Hohenstaufen (hō'en-stou-fn), a German princely family, several members of which filled the imperial throne. The founder of the family was Frederick, lord of Hohenstaufen, a castle in the Suabian Alps, who for his services to the Emperor Henry IV received the Duchy of Suabia, and the hand of his daughter Agnes. His son Conrad was elected emperor in 1138. After the death of Conrad (1152) the confidence which was felt in the Hohenstaufen family caused the choice to fall on his nephew, Frederick III of Suabia, who was followed by Henry VI (1190), who added by his wife the Kingdom of Sicily and Naples to the hereditary dominions of the family; and he again by Otto IV (1197) and Frederick II (1215–50), all belonging to the same House. After the death of Frederick II his son Conrad was acknowledged as his successor, with the title of Conrad IV, by most of the states of the empire; but Innocent IV laid him under an interdict, declared him to be deprived of all his lands, and persecuted him with relentless hatred till his death in 1254. The possessions of the family ultimately fell to Bavaria, Baden, and Württemberg.—Cf. F. von Raumer, *Geschichte der Hohenstaufen.*

Hohenstein (hō'en-stīn), a town of Germany, in Saxony, 10 miles north-east of Zwickau. Pop. 13,397.

Hohenzollern (hō-en-tsol'ern), a small territory of Germany. It consists of a long, narrow, irregular strip of country, entirely surrounded by Württemberg and Baden. Area, 441 sq. miles. Pop. 70,751. Hohenzollern was the family name of the ruling house of Imperial Germany.

Hokusai, Japanese painter, born at Yeddo in 1760, died there in 1849. At the age of thirteen he left home and apprenticed himself to an engraver, but five years afterwards he gave up engraving and studied under Shunsho. He created the popular Japanese style, and produced pictures free from the conventionalities of either his contemporaries or predecessors. His pictures are known as the *Ukiyo-ye* (pictures of this passing world), and are highly appreciated in Western Europe.

Holbach (hol'bȧh), Paul Heinrich Dietrich, Baron von, philosopher, born at Heidelsheim, in the Palatinate, in 1723, died in 1789 in Paris. Educated in Paris, where he passed the greater part of his life, he became the patron and associate of the Encyclopædists, and contributed many papers on natural history, politics, and philosophy to the *Encyclopédie.* The Abbé Galiani called him the *maître d'hôtel* of philosophy. In 1767 Holbach published *Christianisme dévoilé.* The principal work attributed to him, which appeared under the name of M. Mirabaud, is the *Système de la Nature.* This work, which has been called 'the Bible of Naturalism or

Atheism', is said to have offended both Voltaire and Frederick II. He afterwards published *Système social, ou Principes naturels de la morale et de la politique*; *Bons Sens, ou Idées naturelles opposées aux idées surnaturelles* — a sort of atheist's catechism; and *Éléments de la morale universelle*. According to Holbach, matter is the only form of existence, and everything is the effect of a blind necessity. Wolmar, in Rousseau's *Nouvelle Héloïse*, is a portrait of Holbach.

Holbein (hol'bīn), Hans, an eminent German painter, born at Augsburg in 1497, died of the plague at Whitehall in 1543. He studied under his father, Hans Holbein the elder, a painter of considerable merit (1460–1524), and at an early age settled at Basel, where he exercised his art till about 1526, producing some religious pictures, mural decorations (now destroyed), and some notable portraits, including several of his friend Erasmus. He then came to England, where letters from his friend Erasmus, whose *Praise of Folly* he had illustrated by a series of drawings, procured him the patronage of the Chancellor, Sir Thomas More. Here he painted a series of portraits mainly of More and his friends. In 1528 he returned to Basel, but in 1531 finally settled in England. He was appointed court painter by Henry VIII; and in the Windsor collection has left portraits of all the eminent Englishmen of the time. In 1538 he was sent to Belgium to paint the portrait of Christina of Denmark (now in the National Gallery), and in 1539 painted the portrait of Anne of Cleves. He also executed some important mural decorations, now destroyed. A good many of his pictures are supposed to have been destroyed by the Great Fire in 1666. The most celebrated of his pictures are the *Madonna* at Darmstadt (better known through the replica at Dresden), representing the Burgomaster Meyer and his family kneeling to the Virgin; and the Solothurn *Madonna*. His famous *Dance of Death* has only been preserved in the engravings of Lützelburger. There are a considerable number of engravings on wood and copper from Holbein's designs.— BIBLIOGRAPHY: H. Knackfuss, *Holbein*; A. B. Chamberlain, *Hans Holbein the Younger*; R. N. Wornum, *Some Account of the Life and Works of Hans Holbein*.

Holberg, Ludwig, Baron, Norwegian-Danish novelist, poet, dramatist, and historian, the father of modern Danish literature, was born at Bergen, in Norway, then part of the Danish dominions, in 1684, died at Copenhagen 27th Jan., 1754. He studied at the University of Copenhagen, and afterwards travelled through a good part of Europe, spending some time in Oxford, where he taught music and modern languages, and studied modern history and philosophy. In 1718 he was appointed to an ordinary professorship in the University of Copenhagen, where after this date he chiefly resided till his death. In 1735 he was elected rector, and in 1737 treasurer of the university in which he held his professorship, and in 1747 he was raised to the rank of baron. His works may be divided into four classes — poems, stage pieces, philosophical treatises, and historical works. His poems are chiefly of a satirical nature. The most celebrated is *Peder Paars*, a comic heroic poem in fourteen cantos, which is still regarded throughout the Scandinavian countries as a masterpiece. This work was published by him in 1719 under the pseudonym of Hans Mikkelsen, citizen of Kallundberg. Almost equally famous is his *Nicolas Klimm's Subterraneous Travels*, a satirical romance in prose. His stage pieces are all either comedies or farces, and are nearly all characterized by true comic power. Among his philosophical writings the most important is his *Moral Reflections* (1744). His historical works include: *The Political, Ecclesiastical, and Geographical Condition of the Danish Monarchy*; *A General History of the Jews*; and *A History of Famous Men and Famous Women* (1739–46). Holberg made Danish a literary language, and for two centuries his influence was paramount. — Cf. Georg Brandes, *Holberg and his Contemporaries*.

Holcus, a genus of grasses (nat. ord. Gramineæ), extremely common in some pastures, where they are called soft grasses. Whether because of their innutritious quality, or of the soft hairs with which they are covered, they are neglected by cattle. *H. saccharatus* contains a large quantity of sugar, and *H. odorātus* is celebrated for its fragrance. There are only two species native to Britain, woolly soft grass or Yorkshire fog (*H. lanātus*) and creeping-rooted soft grass (*H. mollis*), which are both perennial, growing about 2 feet high when in flower, and equally covered with soft dry hairs.

Holding Over. If a tenant in England disregards written notice to quit at the expiry of his tenancy and retains possession, he is said to 'hold over', and is liable to pay to the landlord as compensation (*a*) double the annual value of the premises should the notice have come from the landlord (except in weekly lets), and (*b*) double the rent should it have come from the tenant himself.

Holiday (a corruption of Holy Day), any day set apart as a religious or national festival; in a general sense, a day or a number of days during which a person is released from his everyday labours. In Britain certain days were fixed as bank-holidays by Parliament in 1871, and it was enacted that all business transactions which would have been valid on any such holiday shall be held as valid if performed on the day following. In England the bank-holidays are Good Friday, Easter Monday, Whit-Monday, the first Monday of August, Christmas Day, and the 26th of Dec. (or the 27th should the 26th be a Sunday). The days fixed as bank-holidays for Scotland are New Year's Day, Good Friday, the first Monday of May, the first Monday of August, and Christmas Day; and if either New Year's Day or Christmas Day falls on a Sunday, the Monday after is held as a holiday. These holidays are observed also by Custom Houses, Inland Revenue, and other public offices.

Hol'inshed, Raphael (Ralph), an English chronicler of whom nothing more is known than that he was descended from a family originally belonging to Cheshire, that he lived in the age of Queen Elizabeth, and that he died about 1580. He is only known by his *Chronicles of Englande, Scotlande, and Irelande*, the first edition of which, known as the 'Shakespeare edition', because it is the one which is supposed to have been used by him in collecting material for his historical plays, was published in London in 1577. In the preparation of this work Holinshed was assisted by several of the most learned men of the day.—Cf. W. G. Boswell Stone, *Shakspere's Holinshed.*

Holl, Frank, R.A., portrait and genre painter, son of Francis Holl, an eminent engraver, was born in London 1845, died 1888. He was a very successful student at the Royal Academy, and exhibited constantly from his student days. Among his best-known pictures are *Faces in the Fire*, *Fern-Gatherers*, *No Tidings from the Sea*, *Leaving Home*, and *The Gifts of the Fairies*. Towards the end of his life he devoted himself to portraiture, in which he greatly excelled, and painted many of the celebrities of the day, including the Prince of Wales, W. E. Gladstone, and Joseph Chamberlain.

Holland, Sir Henry, an English physician, born at Knutsford, Cheshire, in 1788, died in London 1873. He was educated at the University of Edinburgh, where he took the degree of M.D. in 1811. In 1816 he established himself in London as a physician, and he rapidly acquired a great reputation. In 1840 he was appointed physician in ordinary to the Prince Consort, in 1852 physician in ordinary to the queen, and in 1853 was created a baronet. He published *Travels in the Ionian Isles, Albania, and Greece*; *Medical Notes and Reflections*; *Mental Physiology*; and *Recollections of Past Life.*

Holland, Henry Richard Vassall Fox, third Lord, born 1773, died 1840. He succeeded to the peerage by the death of his father when less than one year old. In 1798 he took his place in the House of Lords, and as the nephew of Charles James Fox was at once acknowledged as a Whig leader. In 1806 he was Commissioner for settling disputes with the United States; Lord Privy Seal in 1806–7; and Chancellor of the Duchy of Lancaster. He and his wife made Holland House the resort of the wit, talent, and beauty of his day. He wrote a *Life of Lope de Vega* (1806), *Three Comedies from the Spanish* (1807), *Foreign Reminiscences* (1850), and *Memoirs of the Whig Party* (1852).

Holland, Philemon, physician, teacher, and 'translator-general in his age', born at Chelmsford 1552, died 1637. He became master of the free grammar-school of Coventry, and also practised as a physician. His translations include Livy, Pliny, Plutarch's *Morals*, Suetonius, Xenophon, &c., and he published an edition, with additions, of Camden's *Britannia* (1610).

Holland, Kingdom of. See *Netherlands*.

Holland, North (*Noordholland*), and **Holland, South** (*Suidholland*), two provinces of the Netherlands. The greater part of the former consists of a peninsula, bounded by the North Sea on the west and the Zuider-Zee on the east. Area, 1066 sq. miles. It lies very low, some portions of it being at least partially below the level of the sea, and is generally fertile. A broad margin of downs or sand-hills protects it from the sea on the west. Besides rivers (Vecht, Amstel, Zaan, &c.), it is intersected by the Great North Holland Canal. The chief towns are Amsterdam, Alkmaar, Haarlem, Helder, and Zaandam. Pop. (1919), 1,288,826.—*South Holland*, the most populous province of the Netherlands, is bounded on the north by North Holland, on the west by the North Sea. The southern part of the province is broken up into several islands. Area, 1131 sq. miles. Like North Holland, it is a flat and depressed tract, and it also is protected from the sea on the west by a margin of downs or sand-hills. The chief river is the Rhine, with its numerous branches. The lakes were formerly numerous, but most of them are now drained. The soil is fertile and well cultivated. The principal towns are Delft, Dort, Gorkum, Gouda, Leyden, Rotterdam, Schiedam, 'S Gravenhage (the Hague). Pop. (1919), 1,664,284.

Holland House, a famous mansion in London, on a hill at the west end of Kensington Gardens. It was built in 1607 in the Tudor style, and derived its name from one of its early owners, Henry Rich, Earl of Holland. When Lord Holland was executed for treason, the mansion passed into the possession of the Parliamentary generals, Fairfax and Lambert. It was restored to Lady Holland after the Restoration (1665), but was purchased in 1762 by Henry Fox, afterwards Baron Holland, the father of Charles James Fox, and is now in the possession of his descendants. It was for long the headquarters of the Whig party.

Hollar, Wenzel or Wenceslaus, a Bohemian engraver, born in Prague about 1607, died in London 1677. He accompanied the Earl of Arundel, the British Ambassador to the German Emperor, to London, who employed him to engrave some of the pictures of his collection. Among his numerous works, which are esteemed for their delicate, firm, and spirited execution, and which number some 2740 plates, are a set of twenty-eight plates, entitled *Ornatus Muliebris Anglicanus*, representing the dresses of Englishwomen of all ranks and conditions in full-length figures; Holbein's *Dance of Death*; and etchings from the works of Titian and Van Dyck.

Holloway, Thomas, born 1800, died 1883; proprietor of the popular pills, ointment, &c. He founded a sanatorium or asylum for the insane, and hospitals for incurables and convalescents, at Egham, Surrey, 1873; and also at the same place the *Royal Holloway College*, designed to supply the best and most suitable education for women of the middle classes. The college, which was opened by Queen Victoria in 1886, contains a collection of pictures of the value of £100,000. The total cost of the two institutions was about a million sterling.

Hollow Ware, the name given to all classes of vessels used for general household purposes, cooking, &c. These vessels are made of cast or wrought iron, steel, copper, brass, nickel, aluminium, &c. For purposes other than cooking the articles are generally galvanized, as in the case of buckets, &c., to protect the metal from rusting and corrosion, or enamelled, as in the case of pans, &c. Cooking-utensils are frequently made of cast iron or pressed steel, and may also be enamelled or tinned. Many cheap articles are made of thin tinned steel sheet, and better-class articles are made of the same material fitted with copper bottoms. Formerly copper and brass were largely used in the manufacture of cooking utensils; these have to be kept scrupulously clean, owing to their tendency to form the poisonous substance known as verdigris. Metallic nickel makes an ideal material for the manufacture of cooking-vessels, but is expensive; it was largely used on the Continent for this purpose before the European War, especially in Austria. Aluminium is also now largely used and has many advantages; for example, culinary utensils made of aluminium are light, are absolutely free from verdigris met with in copper or brass articles, rust met with in iron and steel articles, and the chipping difficulty met with in enamelled goods. Cast aluminium utensils are generally used for the heavy wear met with in hotels, restaurants, &c., whereas wrought vessels are used for general household purposes.

Holly (Ilex), a genus of plants of the ord. Aquifoliaceæ, embracing a number of evergreen trees or shrubs. The common holly (*I. aquifolium*) is common in Britain and the continent of Europe. It is a handsome, conical evergreen tree, growing to the height of 20 or 30 feet. Its leaves are dark-green, shining, and leathery, abundantly armed with prickles on the lower branches, but free from them on the upper, or on very old trees. The flowers are white, appearing in May; the fruit is red, ripening in September, and remaining on the tree all the winter. A good many varieties are known, distinguished by the shape and colour of the leaves, which are sometimes spotted or edged with yellow, &c. It is excellently adapted for hedges and fences, as it bears clipping. The wood is hard and white, and is employed for turnery work, knife handles, &c. The bark yields a mucilaginous substance, from which birdlime is made. Among the Romans it was customary to send boughs of holly to friends, with new-year's gifts, as emblematical of good wishes; and it is used to decorate houses at Christmas. Some have assumed that the name 'holly' is equivalent to 'holy tree', being derived from the custom of using the branches and berries of the tree for the decoration of churches at Christmas. The American holly (*Ilex opaca*) is widely diffused throughout the United States. It sometimes attains the height of 80 feet, with a trunk 4 feet in diameter. The *I. glabra* is another species of holly, inhabiting the coast regions of the United States. Its leaves furnished the 'black drink' which used to hold an important place in Indian ceremonies. The *Yerba maté* or Paraguay tea-plant is a species of holly (*I. Paraguayensis*).

Holly (*Ilex aquifolium*)

A, Flower. B, Berries. C, Section of berry.

Hollyhock, a biennial plant (*Althœa rosea*), nat. ord. Malvaceæ. It is a native of China, and is a frequent ornament of gardens. There are many varieties, with single and double flowers, characterized by the tints of yellow, red, purple, and dark purple approaching to black. It reaches a height of 8 feet or more.

Holmes (hōmz), Oliver Wendell, American essayist, poet, and physician, born at Cambridge, Mass., 1809, died in 1894. He was educated at Harvard University, began the study of law, but in a short time relinquished it for that of medicine. In 1839 he became professor of anatomy and physiology in Dartmouth College, N.H., but resigned after two years' service in order to devote himself to practice in Boston. In 1847 he was appointed to the chair of anatomy at Harvard, a position which he filled till 1882. He was a voluminous writer both in prose and verse, and shone as a prominent figure in the famous group associated with *The Atlantic Monthly.* His chief works, besides several volumes of poems, and treatises on medicine, are: *The Autocrat of the Breakfast Table*, *The Professor at the Breakfast Table*, and *The Poet at the Breakfast Table*; *Elsie Venner*, *The Guardian Angel*, *A Mortal Antipathy*, and *Emerson* (in American Men of Letters Series). A visit to Europe in 1886 produced a charming record, *Our Hundred Days in Europe*.—BIBLIOGRAPHY: J. T. Morse, *Life and Letters of Holmes*; W. Jerrold, *O. W. Holmes*; L. W. Townsend, *O. W. Holmes*.

Holm-oak (*Quercus Ilex*), a shrub-like tree, native of the Mediterranean countries, with holly-like leaves. In its native countries it attains a considerable size and age, but in Britain it forms an ornamental evergreen bush of from 20 to 30 feet high, seldom becoming single-stemmed.

Holocephali. See *Chimœra.*

Holograph (Gr. *holos*, entire, and *graphein*, to write), any writing, as a letter, deed, will, &c., wholly written by the person from whom it bears to proceed. In Scots law a holograph deed is valid without the signatures of witnesses, but in English law every deed, whether holograph or not, must have the names of two witnesses attached to it to render it valid.

Holoptychius (-tik′i-us; Gr. *holos*, entire, and *ptyx*, fold), a genus of fossil ganoid fishes occurring in the Upper Old Red Sandstone. The head was covered with large plates, and the body with bony scales, with their exposed surfaces roughly grooved. The pectoral fins were long, and the jaws were armed with pointed teeth of unequal size. A fine Scottish example is more than 2 feet long.

Holothuria, the type of a class of Echinoderms, the Holothurioidea or sea-cucumbers. These are typically cylindrical in form, and covered by a leathery skin in which scattered calcareous plates are embedded. Longitudinal rows of tube-feet are commonly present. They have the mouth surrounded by branching tentacles; a long convoluted alimentary canal; respiratory organs near the anus, and generally in the form of two branching arborescent tubes ('respiratory trees') into which the water is admitted. They are capable of great extension in length, and of extraordinary reproduction of parts, even of vital organs. The young undergo a metamorphosis during development. Remarkable deep-sea forms (Elasipods) are known, in which the body is bilaterally symmetrical; and there is one free-swimming species (Pelagothuria). In some cases (Synapta) tube-feet are absent, and the calcareous plates are shaped like wheels and anchors. Trepang or bêche-de-mer consists of the dried bodies of various holothurians abounding in the Malayan seas.

Holstein. See *Schleswig-Holstein.*

Holy Alliance, a league concluded at Paris, 26th Sept., 1815, between Alexander I, Emperor of Russia, Francis of Austria, and Frederick William III of Prussia, and signed with their own hands, without the countersignature of a minister. It consisted of a declaration, that, in accordance with the precepts of the gospel of Jesus Christ, the principles of justice, charity, and peace should be the basis of their internal administration, and of their international relations, and that the happiness and religious welfare of their subjects should be their great object. Its real aim, however, was to maintain the power and influence of the existing dynasties. It was offered for signature to all the European Powers except the Pope and the Sultan of Turkey, and accepted by all except Britain. The document was drawn up by Tsar Alexander I, and was signed by the three rulers. The Tsar was inspired by the Baroness von Krüdener, and, as far as he himself was concerned, the Holy Alliance was the scheme of a pietistic idealist, but it was used by Metternich, and afterwards by Russia and France, as an instrument of reactionary policy. The events of 1848 broke up the Holy Alliance.—Cf. A. S. Rappoport, *The Curse of the Romanovs* (with bibliography).

Holy Carpet (Ar. *Kisweh*), outer covering of the Kaaba (q.v.). It is manufactured at Cairo, and sent with a caravan of pilgrims to Mecca. The holy carpet is made of coarse black brocade, with inscriptions from the *Koran* interwoven in it in silk of the same colour. Across each side it has a large band covered with inscriptions worked in gold. The carpet is presented annually to the Shrine, remains on the Kaaba for a year, and is then cut into pieces and sold to the pilgrims at exorbitant charges.

Holy Coat of Trèves, a relic preserved in the cathedral of Trèves, and said to be the identical seamless coat worn by our Saviour at his crucifixion, and for which the soldiers cast lots. It was the gift of the Empress Helena, by whom it was discovered in her visit to Palestine in the fourth century. It has been exhibited to vast numbers of pilgrims at irregular intervals, for the last time in 1891, when it was seen by nearly two million pilgrims. The same claim is made for several coats kept in other places.

Holy Family, in art, representations of the infant Saviour and his mother, accompanied by one or more members of his family. The earliest composition is that in the catacomb of St. Calixtus in Rome. During the Middle Ages other figures, such as St. Anna, St. Joseph, and John the Baptist, were added to those of the Virgin and the Saviour. The Madonna and Child was a favourite subject of the artists of the Italian Renaissance. Among the painters of the Holy Family are: Raphael, Correggio, Giulio Romano, Leonardo da Vinci, Michael Angelo, Dürer, Rubens, and Murillo.

Holy Ghost. See *Holy Spirit.*

Holy Ghost, Order of, an order of male and female hospitallers, founded by Guy, son of William, Count of Montpellier, towards the end of the twelfth century, for the relief of the poor, the infirm, and foundlings. After the middle of the eighteenth century it was united with the order of St. Lazarus by Clement XIII. This was also the name of the principal military order in France instituted in 1578 by Henry III, abolished in 1789, revived at the Restoration, and definitely abolished on 10th Feb., 1831, by Louis Philippe.

Holy Grass (Hierochlŏe), an odoriferous genus of grasses belonging to the Phalarideæ, and consisting of several species spread over the cold parts of both hemispheres. The *H. boreālis*, or northern holy-grass, is found in Scotland, Iceland, and throughout Northern Europe, Asia, and America, and occurs also in New Zealand. It owes its name to the practice adopted in some parts of Germany of strewing it before the doors of churches on festival days.

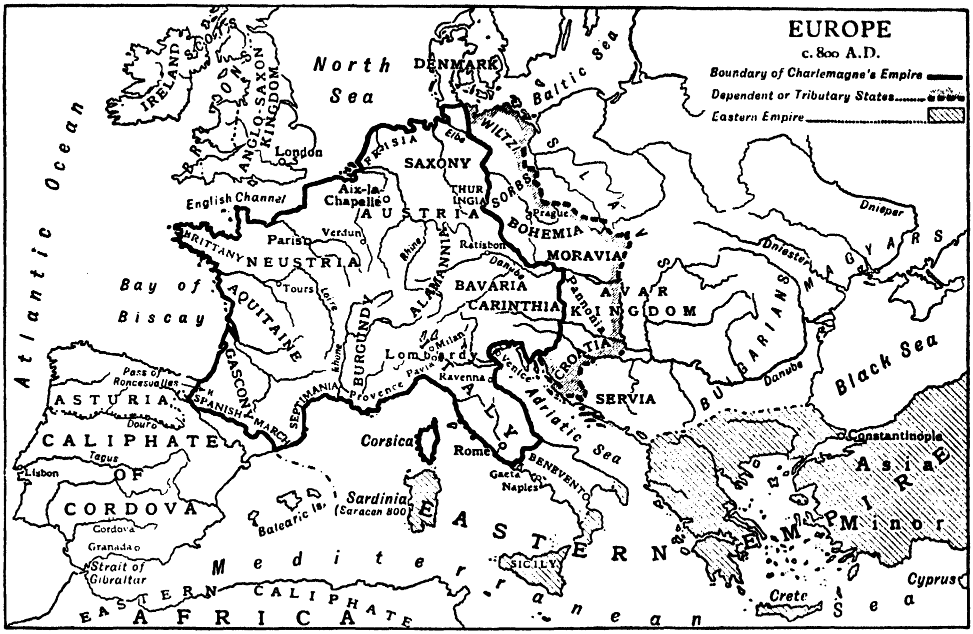
Holyhead, an island, urban district, and seaport town of North Wales, in the county of Anglesey. The island is about 7 miles long, and 5 miles broad at the widest part, is situated off the west side of Anglesey, and is connected with the mainland by a causeway. The town is on the north-east side of the island, and owes its prosperity to the railway and steamboat traffic between England and Dublin. The harbour of refuge (Victoria Harbour), opened in 1873, is formed by a breakwater which is 7860 feet in length, and was built at a total cost of £1,500,000. Pop. 11,757, (1921).

Holy Island, or **Lindisfarne**, an island off the north-east coast of England, 11 miles south-east of Berwick. It is 1¾ miles from the mainland, with which it is connected by a narrow neck of sand, traversable at low water. It is of an irregular form, about 2¼ miles in length, and about 1½ miles in breadth at the broadest part. The village of Lindisfarne on the south-west is much resorted to by summer visitors, but the great object of interest is the extensive ruined abbey of Lindisfarne, founded in A.D. 635 by Oswald, King of Northumbria, destroyed by the Danes, and restored by the Normans in 1082. The castle, on a rock 90 feet high, also dates from an early period. Pop. 359.

Holy League, a term applied to several political alliances formed in Europe. The principal leagues were the following: (1) The alliance formed in 1510 by Pope Julius II, Ferdinand V of Spain, and the Republics of Switzerland and Venice against Louis XII of France; it was dissolved in 1513. (2) The alliance formed in 1571 by the Pope, Spain, and Venice against the Turks. (3) The coalition formed in 1576 at Péronne, in France, by the Pope, Spain, the Guises, and the Parliament of Paris, with the object of preventing Henri of Navarre from ascending the throne of France. This league lasted till 1593, when Henri embraced Catholicism. (4) The Holy League (also known as the Catholic League) formed by the Catholic states of Germany in 1609 against the Protestant Union.

Holyoke, a city of Hampden, county Massachusetts, on the west bank of the Connecticut River. It is a prosperous manufacturing place, its rise dating from 1849, when a dam constructed across the river supplied it with extensive water power. It has manufactures of paper, cotton, wool, and wire; and machine works. Pop. 60,303 (1920).

Holy Roman Empire. The political institution known as the Holy Roman Empire was founded in A.D. 800, and came, formally, to an end in 1806. It was a revival of the ancient Roman Empire which claimed authority over the whole civilized world. The Roman Empire, before it fell in Western Europe, had been divided into two rival powers at Rome and at Constantinople; the Western Empire was destroyed by barbarian invasions in the fifth century, and the Eastern Empire survived until it was destroyed by the Turks in the fifteenth century. The Holy Roman Empire represented the ancient Western Empire, and its revival was a tribute to the impression made upon men's minds by the power of 'eternal Rome' and by the supreme authority which had been exercised by the Emperor. When the King of the Franks, Charles the Great, came to dominate Europe in the end of the eighth century, he was fascinated by the ancient ideal of one great secular Power, acting as the partner and the protector of the Christian Church in the government of the world. The Church, as represented by the Papacy, was threatened by many enemies, and in 800 Charles led a Frankish army to the support of the Pope. On Christmas Day he was crowned in St. Peter's Church by the Pope, as Charles Augustus, an incident which is regarded as the most important European event of the early Middle Ages, and was acclaimed by contemporaries as likely to bring peace and good order to a troubled world. Charles considered himself to be Emperor by divine appointment, and believed that he held a divine commission to rule the nations and protect the Church. He did not admit that the imperial dignity had been conferred on him by the Pope or by the Roman populace which acclaimed his coronation, and he asserted the right of naming his successor. During his lifetime, his theory of an Empire, holy and supreme, was realized, but after his death, in 814, his descendants quarrelled among themselves, and the titular Emperor ceased to exert any authority outside the regions under his own immediate rule. Further, personal rivalries for the imperial title gradually gave to the Papacy the right of choosing the Emperor, and from the coronation of Charles the Fat, in 881, the imperial office was the gift of the Pope.



In the end of the ninth century there was a new series of barbarian invasions, and the Carolingian Empire was destroyed by Saracens, Norsemen, Danes, Wends, and Hungarians, but memory clung to the imperial institution as the hope of mankind, and when a great German ruler arose in the person of Otto the Great, who became King of the East Franks in 936, he repeated the experiment which had been tried by his famous predecessor. The Pope, the worthless John XII, appealed to Otto for aid, and on 2nd Feb., 962, he was crowned Emperor amid the plaudits of a generation which trusted in the beneficent co-operation of a Universal Empire and a Universal Church. Papacy and Empire were to be interdependent, and Pope and Emperor were to be the Vicars of God upon earth, the one in matters spiritual and the other in matters temporal. The canon law of the Church was to be the complement of the civil law of the Empire, and Church and Empire were believed to be but two sides of one divinely appointed ordinance for the well-being of human society. The theory assumed the harmony of the two Universal Powers, and the hold which it had on men's minds is proved by the persistence with which it was cherished, in spite of the fact that this essential harmony was never attained. Otto I began his rule as Emperor by trying and deposing John XII, and he obtained a recognition of a claim that the election of a Pope required the imperial confirmation. The disputes between the Papacy and the Emperor did not, however, become vehement under the Saxon Emperors—Otto I and his successors, Otto II (973–983) and Otto III (983–1002)—partly because of the weakness of the Papacy during these years, and partly owing to the friendship between Otto III and the reforming Popes, Gregory V and Sylvester II. The Saxon line ended with Otto II, whose successor was a Bavarian, Henry II. He also remained on good terms with a reforming Pope, Benedict VIII, and his main interest, unlike that of the Ottos, was in Germany, not in Italy. These were the two regions which, for practical purposes, formed the Empire, and the attention of the Emperors was usually concentrated on one or the other of them. There were shadowy claims to imperial authority over Hungary, Denmark, France, and even England, but the first three of these countries soon insisted on their independence, and the only claim to any control over England was an arrangement made, at a later date, between Richard I, as a prisoner, and the Emperor Henry VI. The Holy Roman Empire may be said to have reached the height of its power under Henry II and his successor, Conrad II (1024–9), a Franconian, who conciliated the powerful ecclesiastics who were engaged in what is known as the Clugniac Reformation of the Church. The reign of his son and successor, Henry III, affords the last illustration of the successful operation of the Imperio-Papal theory of government, but it was successful only because the Emperor was able both to nominate Popes and to use them as his political agents in Italy, and also to gain the confidence of the reforming party in the Church.

When Henry III died in 1056, the Empire had been weakened by the rise of the Norman power in Southern Italy, and the Papacy could use the Normans against the Emperor. It found another potent ally in the Countess Matilda of Tuscany, and was ready to enter upon a struggle to shake off the imperial authority. The conflict came in the reign of Henry IV (1056–1106), which marks the turning-point in the history of Empire and Papacy. In 1059 the Church claimed that the nomination of a Pope belonged to the College of Cardinals, and about the same time the ecclesiastical objection to the investiture of bishops by secular princes (see *Investiture*) brought about a serious dispute. Henry was involved in a civil war caused by the rebellion of the Saxons against his rule; Pope Gregory VII (Hildebrand) excommunicated him in 1076, and Henry summoned an ecclesiastical Synod which deposed the Pope. At Canossa, in 1077, Henry went through a humiliating submission and received the Pope's absolution, but the conflict continued. In 1080 Henry created an Anti-Pope, and had himself to face an Anti-Emperor, but he subdued his Saxon enemies, and in 1084 he captured Rome and was crowned by the Anti-Pope, while Gregory VII held out in the castle of St. Angelo until his Norman allies came to his aid. They sacked the city, and Gregory had to flee to Salerno, where he died in 1085. Henry survived until 1106, but the rest of his reign was occupied in conflicts with the Papacy, with his German subjects, and with his own son, who reigned as Henry V (1106–25), and in 1122 closed the Investiture controversy by the Concordat of Worms.

The next two reigns, those of Lothar II (1125–38) and Conrad III (1138–52) form an interlude in the long struggle between Empire and Papacy. They witnessed the growth of great ruling Houses in Germany, possessed of rival ambitions, and the development of an Electoral College of princes for the nomination of the Emperor. Conrad III was the first of the Hohenstaufen dynasty, and was succeeded by his famous nephew, Frederick I (Barbarossa), who speedily became involved in a new quarrel with the Papacy. Under Henry IV the causes of quarrel had been definitely religious, but in the time of Frederick I they were political, for the Papacy, which had been enriched by the inheritance of Matilda of Tuscany, entertained great territorial ambitions, and was creating an independent Papal State which included the whole of the middle of Italy. Frederick's first antagonist was the only English Pope, Hadrian IV, who claimed that the Empire was a fief held by the Emperor from the Pope. Hadrian found allies not only in the Normans but also in the Lombard Republics, which believed that their interests were threatened by the policy of the Emperor; but he died in 1159 just as war seemed likely to break out. There was a disputed election, and the quarrel between Pope and Anti-Pope involved the question of the predominance of the Empire in Europe. Frederick invaded and conquered the north of Italy, but the Lombard League ultimately drove him out in 1168, and in 1176 he was defeated at Legnano and compelled to acknowledge his enemy, Pope Alexander III. He strengthened his position by the Peace of Constance in 1183. By that time attention had been diverted to the Holy Land through the capture of Jerusalem by the Seljuk Turks in 1180, and Frederick died while leading the first armies of the Third Crusade. The short reign of his son, Henry VI (1190–7), was notable for his marriage with the heiress of the Norman Kings of Sicily, an alliance which menaced the territorial power of the Papacy.

When Henry died, he left a small boy, afterwards Frederick II, who was crowned King of Sicily. The great Pope, Innocent III, was bent on the establishment of a Papal State, and was determined to prevent the union of Sicily and the Empire, and this became the main object of Papal policy. There was a disputed imperial election between Philip of Suabia and Otto IV, the son of Henry the Lion, a Saxon noble who had played a great part in the reign of Frederick Barbarossa. Philip was murdered in 1208, and Otto, who had been supported by Innocent III, quarrelled with the Pope and allied himself with his cousin, King John of England, but he was defeated at Bouvines in 1214 and died soon afterwards. Frederick then became Emperor at the age of twenty, and his reign (1215–50) was spent in constant conflict. Educated among Greeks, Normans, Lombards, and Saracens, he was a man of wide culture and sympathies, and he encouraged art and founded the University of Naples. His political aims were the incorporation of Sicily in the Empire and the destruction of the temporal power of the Papacy in Italy. These were the real questions at issue, but the actual quarrel with the Papacy arose over his failure to fulfil his solemn vow to go on a Crusade. In 1227 he was excommunicated by the Pope for not going, and when he went, in the following year, the excommunication was renewed, and although he succeeded in obtaining the cession of Jerusalem to the Christians, the ban was not removed until 1230. The Papacy continued to be on the side of the enemies of the Empire in Italy and in Germany, and the imperial authority was greatly weakened by another struggle with the Lombard League. The reign of Frederick II, ‘the Wonder of the World’, ended in failure, and the Empire fell with him. His son, Conrad IV, had a brief and troubled reign, and there followed an Interregnum (1256–73), during which there was no recognized Emperor.

The failure of the great House of Hohenstaufen proved the impracticability of the imperial ideal, and though the name was revived, the Holy Roman Empire really ceased to exist. After the Interregnum the Empire was essentially a German Empire, though it retained the old name and was ready to advance the old pretensions. As a German Empire it had a chance of a great future, for the local rivalries of the German princes would not allow of any attempt at German unity except under an Emperor whose title satisfied German arrogance by its claim to supreme authority all over the Western world. In 1273 Rudolf, Count of Habsburg, was elected Emperor by the German princes, and the House of Habsburg entered upon its long career of aggrandizement. Rudolf I (1273–91) was merely a German ruler, with much less actual power than the sovereigns of France or of England, and his aim was to create a great imperial territory in Germany in order to provide support for his titular authority. He abandoned the old imperial claims to Italy and made an alliance with the Pope, and after a war with the Bohemians he was able to secure the fiefs of Austria, Styria, and Carinthia for his own family. He failed to obtain a hereditary status for the Empire, and his immediate successor was Adolf of Nassau (1292–8), but, on Adolf's deposition, Rudolf's son, Albert of Austria (1298–1308), was elected. He failed to protect the Empire from the growing power of France, and French influence over some of the German princes brought the Empire into the House of Luxemburg, in the person of Henry VII (1308–13), who tried to restore the imperial power in Italy and died in his Italian expedition. The election which followed was disputed between Lewis IV of Bavaria (1313–47) and Frederick of Austria, but Lewis overcame his rival and renewed his predecessor's attempt in Italy. He was at first successful, and was crowned in 1328 at Rome, where he deposed Pope John XXII, but he was not strong enough to hold the country, and the end of his reign was unfortunate in Germany. After his failure the Empire passed again to the House of Luxemburg, and Charles IV (1347–78) abandoned the Italian claims and devoted himself to Germany. By the famous Golden Bull of 1356 he settled the method of election to the Empire and attempted to lay the foundation of German unity. He was himself King of Bohemia, and he increased the territorial possessions of his House, but his later years were troubled, and he weakened his son and successor, Wenzel (1378–1400), by dividing his territories among his family. Wenzel found it impossible to maintain the authority of the Empire against his opponents in Germany and Bohemia, and a schism began with his deposition in 1400. It was healed by the election of Sigismund (1411–37), King of Hungary, whose reign was occupied by the Hussite wars and by an attempt to conquer Bohemia.

After Sigismund's death the Empire passed permanently into the House of Habsburg. The first of the continuous Habsburg line, Albert II, Duke of Austria, and King of Hungary and Bohemia, died a year after his election as Emperor, leaving a posthumous son, whose title was acknowledged in Austria and Bohemia. His successor as Emperor was a cousin, Frederick III (1440–93), who attempted with the help of the Papacy to recover Austria, Hungary, and Bohemia. His long reign was almost uniformly unfortunate, but his son Maximilian made a marriage with the heiress of the large dominions of the Duke of Burgundy, and at the end of his life he was able to regain Austria and to make an arrangement by which Hungary and Bohemia were ultimately to pass to the Habsburgs. With the reign of Maximilian I (1493–1519) began an attempt to reform the Constitution of the Empire. The Electoral Princes formed the first chamber of the Diet or governing body, and there were other two chambers, composed respectively of princes, clerical and lay, and of the representatives of the imperial cities. The Diet, with the sanction of the Emperor, could pass legislation and punish offenders with the 'ban of the Empire', but its internal jealousies rendered it ineffective, and, at the best, the authority of Emperor and Diet had little weight in the independent states which formed the Empire. At the Diet of Worms, in 1495, some of the Electoral Princes proposed a scheme for enforcing the imperial authority, but combined it with conditions which would have created a check on the Emperor by the action of a Central Council; Maximilian refused the demand, and some lesser reforms were attempted. His great position in Europe increased the prestige of the Empire, but during his reign the Swiss Confederation, which had been loosely connected with the Empire, succeeded in vindicating its independence. His grandson and successor, Charles V (1519–56), was not only Emperor and Duke of Austria. As the grandson of Maximilian's wife, he inherited Burgundy and the Low Countries, and from his mother, Joanna, daughter of Ferdinand and Isabella, he also inherited Spain, Naples, and the Spanish colonial dominions. His vast possessions and the influence which he acquired in Italy by force of arms revived for a time the old greatness of the Holy Roman Empire, which seemed to have an opportunity of becoming again a European, and not merely a German, political institution. His power in Germany was lessened by his grant to his brother Ferdinand both of Austria and of the Habsburg claims on Hungary and Bohemia, and in his time Germany was torn asunder by the Reformation, the Peasants' War, and the War of the League of Schmalkalde. Charles identified the Empire with the cause of the Roman Church, and failed in his effort to repress Protestantism and establish religious uniformity, and he left the German Protestants the enemies of the imperial authority.

On the abdication of Charles V his son, Philip II, became the ruler of Spain and the Netherlands, but the new Emperor was Charles's brother, Ferdinand I (1556–64), who was already King of Hungary and Bohemia, and the Empire again became definitely German. The religious question had been partially settled at the end of the reign of Charles by a compromise known as the Peace of Augsburg (1555), and neither Ferdinand nor his son, Maximilian II (1564–76), made any attempt to disturb it. But two great forces were at work which were ultimately to bring about a struggle that profoundly modified the position of the Empire. By the date of the accession of Rudolf II (1576–1612), the influence of the counter-Reformation had become very powerful, and, on the other hand, the Peace of Augsburg had made no provision for the recognition of Calvinism, which was strong in Western Germany. Rudolf was a weak ruler and was deposed, and Matthias (1612–9), the brother who succeeded him, was old and childless. Before his death he arranged for the succession of his cousin, Ferdinand, Duke of Styria, alike to the hereditary possessions of the Habsburgs and to the elective crowns of Hungary and Bohemia. He was successful in obtaining the necessary recognition from the Estates both of Hungary and of Bohemia, but the Bohemian Protestants feared the rule of an heir who was known to be a strong Catholic, and in 1618 occurred the Bohemian Revolution which was the beginning of the Thirty Years' War. At first the Empire under Ferdinand II (1619–37) seemed likely to be able to repress the German Protestants, for the division between Lutherans and Calvinists was acute, but the intervention first of Sweden and then of France turned the scale, and in its last stages the war was rather a duel between France and the Empire than a religious war in Germany. By the Treaty of Westphalia (1648) the Empire became distinctively Austrian, and the attention of Ferdinand III (1637–57) and his successors became more and more occupied by imperial interests in the east of Europe. In the west the Emperor had to face not only the growing power of France but also a new rivalry from the northern state of Brandenburg-Prussia. In the east a more immediate danger came from the revival of the power of the Turks, who, in the course of the long reign of the Emperor Leopold I (1658–1705), invaded Austria and besieged Vienna in 1683; the city was saved by the Polish hero John Sobieski. Leopold also took part in the European opposition to the aggrandizement of France under Louis XIV, but the essential weakness of the Empire was illustrated by the circumstance that some of its western states, and especially Bavaria, were sometimes in alliance with the French. The Emperor took a part in the War of the League of Augsburg, which was formed in 1686 and greatly strengthened by the accession of William III in England and Scotland in 1689, when it became the Grand Alliance. The War of the Spanish Succession was fought to place Leopold's younger son, the Archduke Charles, on the Spanish throne, but by the close of the war he had succeeded his brother, Joseph I (1705–11), as Emperor, and his allies had no wish to revive the union of the Empire with Spain. By the Treaties of Utrecht, Rastadt, and Baden (1713–4), the Emperor received Naples, the Milanese, Sardinia, and the Netherlands as compensation for his claims. This arrangement emphasized the practical disruption of the Empire which had been produced by the Peace of Westphalia. It became, in fact though not in name, an Austrian Empire with a formidable German rival in the new kingdom of Prussia, and the territories in the Netherlands and in Italy were not states of the Empire but Austrian possessions. Under Charles VI (1711–40) Austria was engaged in the Turkish War, which had continued almost without interruption for half a century, and in various European struggles, and his later years were occupied in an attempt to secure the 'Pragmatic Sanction', an agreement by which his daughter, Maria Theresa, was to succeed to his territories.

The Empire was greatly weakened by the war which followed the death of Charles VI, for Frederick II of Prussia advanced some ancient and dubious claims to the province of Silesia, a dependency of Bohemia, and wrenched the greater part of it from the queen, an event which led to the Austrian Succession War in Europe. After a short reign of Charles Albert of Bavaria as Charles VII (1742–5), the imperial crown was given to Francis I (1745–65), the husband of Maria Theresa, and was ultimately restored to the Habsburg House in the person of her son Joseph II (1765–90). The Austrian Succession War was closed by the Treaty of Aix-la-Chapelle in 1748, by which the Emperor and his wife acknowledged the cession of what was thenceforth Prussian Silesia, and an effort to recover it in the Seven Years' War was unsuccessful. Both Maria Theresa and Joseph II made important constitutional reforms in the Empire, but these related solely to the Austrian territories, with which the imperial authority had become almost entirely identified. Joseph increased the Austrian possessions by the first Partition of Poland (1772). He died a year after the French Revolution began, and in the last months of his life the revolutionary ferment spread to the Austrian Netherlands, where a republic was proclaimed. His successor, Leopold II (1790–2), espoused the cause of Louis XVI, and his son Francis II, the last Holy Roman Emperor, began the war against revolutionary France. In the course of the long struggle the position of the traditional Empire became farcical, for out of its component states new kingdoms and electorates were created and old ones ceased to exist. When, in the summer of 1806, Napoleon, as Emperor of the French, formed with Bavaria, Württemberg, and other states which had belonged to the Empire, the Confederation of the Rhine, these states renounced their nominal allegiance to the Holy Roman Empire, and Francis resolved on its formal dissolution. In his deed of abdication (6th Aug., 1806) he recognized what had long been the fact by describing the dying institution as the 'German Empire', and he took the title of Emperor of Austria, and repudiated any power or responsibility outside his own territorial dominions. The Holy Roman Empire had lasted, with some interruptions, for 1006 years, but from the death of Frederick II, in 1250, the old ideal which inspired the name had ceased to have any practical significance; it had been a German Empire from 1273 and an Austrian Empire since 1648. After the fall of Napoleon its revival was suggested, but it would have accentuated the rivalry of Prussia and Austria, and the idea was abandoned. It had long lost its ancient prestige, and contemporaries thought of it, in the words of Voltaire, as "neither Roman, nor holy, nor an empire". —BIBLIOGRAPHY: Viscount Bryce, *The Holy Roman Empire*; H. Fisher, *The Mediæval Empire.*

Holyrood, Palace and Abbey of, in Edinburgh, at the eastern extremity of the old town. The abbey church, founded in 1128 by David I, containing the royal vault, with the ashes of numerous members of the Scottish royal race, is now mostly in ruin. The palace is a large quadrangular building of hewn stone, with a court within surrounded by a piazza. It was erected in successive parts from 1501 to 1679, contains the private royal apartments in modernized condition, the rooms associated with the events in the reign of Mary Queen of Scots, such as the murder of Rizzio, and a gallery 150 feet long, in which are portraits of all the Scottish kings, most of them imaginary. Until 1880 the abbey and its precincts possessed the privilege of sanctuary for insolvent debtors. The King Edward memorial at Holyrood includes ornamental gates and a statue. Part of the palace is used by royalty as an occasional residence.

Holy Spirit, or Holy Ghost. 'Ghost' is the old English term for 'spirit', which is rightly substituted for the older term in the Revised Version of the English Bible. God's 'Holy Spirit' is mentioned twice in the later sections of the Old Testament (*Is.* lxiii, 10, 11; *Ps.* li, 11), and in both places it is an equivalent for the sacred presence of God in the community, which is outraged by sin. '*The* Holy Spirit' is a New Testament expression, which also denotes the relation of God to His people, not to nature, but which assumes special prominence in connection with the person and work of Jesus Christ. It denotes the power of God over human personality, personified often until 'the Holy Spirit' occupies a position which the later Church defined as trinitarian, i.e. the unity of God is revealed in the Father, the Son, and the (Holy) Spirit, who are neither three aspects nor three individuals.

In the New Testament the Holy Spirit is represented as the divine power which operates at the birth of Jesus, the Son, which inspires Him at His baptism for His work, and continues to inspire Him against the powers of evil, as a prophet and as a conqueror of demons. But it is only after His death and resurrection that the Holy Spirit is given to His people. The sphere of the Spirit's work is now the Church, or fellowship of those who believe in God through Jesus Christ; it completes the spiritual presence of the Lord in various ways: by (i) awakening the mind and conscience; (ii) by regenerating the nature of the believer; (iii) by uniting him to the Lord; (iv) by inspiring to prayer, hope, and service; and (v) by binding believers together in unity. Many supernatural phenomena are associated with the Holy Spirit, especially in the earlier books of the New Testament; miracles and ecstasy are described as accompaniments of the Spirit in the primitive Christian society. But there is a tendency, particularly in St. Paul's epistles and in the *Gospel of John*, to lay deeper stress upon the inner, spiritual experience, to emphasize faith and love as the supreme manifestations of the Spirit, and to minimize the intermittent phenomena. Its manifestations are sought in (i) Scripture, which is viewed as the speech of the Holy Spirit, and in (ii) the sacraments of baptism and the Lord's Supper. The former bring out the anticipations of Christ in the past (the Old Testament being regarded as an inspired prediction of Christ); the latter emphasize the present power of the Spirit as regenerating, illuminating, and sustaining the Christian life. But the Holy Spirit is also viewed as the pledge of future bliss, for the possession of this gift of God guarantees the future and final perfection of the believer.—BIBLIOGRAPHY: H. B. Swete, *The Holy Spirit in the New Testament*; W. T. Davison, *The Indwelling Spirit.*

Holy Spirit Plant, an orchidaceous plant (*Peristeria elata*) of Central America, known also as the *dove-plant*, from the resemblance of the united stamens and pistil of the flower to a dove hovering with expanded wings, somewhat like the conventional dove seen in artistic representations of the Holy Ghost. It has a spike of almost globose, sweet-scented flowers of a creamy white, dotted with lilac on the base of the lip.

Holy Water, in the Greek and Roman Catholic Church, salted water which has been consecrated by prayers, exorcism, and other ceremonies, to sprinkle the faithful and things used for the Church. It is placed at the door of churches, so that worshippers may sprinkle themselves with it as they enter, and it is used in nearly every blessing which the Church gives. Sprinkling the people with holy water seems to date from the ninth century, and it is considered efficacious not from any virtue of its own, but from the effect of the Church's prayers at the time of using.

Holy Week, or **Passion Week,** is that which immediately precedes Easter, and is devoted especially to commemorating the passion of our Lord. The days more especially solemnized during it are Spy Wednesday, Maundy Thursday, Good Friday, and Holy Saturday. It is an institution of very early origin, and is known as Great Week, Silent Week, or Penitential Week. Spy Wednesday was a name given in allusion to the betrayal of Christ by Judas Iscariot. Maundy or Holy Thursday specially commemorates the institution of the Eucharist.

Holywell, a market town in Flintshire, North Wales, on the estuary of the Dee, 17 miles S.W. of Liverpool. It takes its name from the well of St. Winifred, one of the most copious springs in Britain, long a famous resort for the supernatural cure of bodily disease and infirmity. The well is covered by a small Gothic building of early date. Near the town are coal- and lead-mines, and quarries. Pop. 2907.

Homage (O.Fr. *homage*, Lat. *homo*, man), in feudal law, a formal acknowledgment made by a feudal tenant to and in presence of his lord on receiving the investiture of a fief or coming to it by succession, that he was his vassal. The tenant, being ungirt and uncovered, kneeled and held up both his hands between those of the lord, who sat before him, and there professed that " he did become his man, from that day forth, of life and limb, and earthly honour ", and then received a kiss from his lord.

Homburg vor der Höhe, a town of Prussia, province of Hesse-Nassau, 9 miles N.N.W. of Frankfort. It is much frequented on account of its mineral springs and bathing establishment, to which gaming-tables were formerly attached, but were suppressed in 1872. The waters are of two classes, those of three springs being purgative, and used for complaints of the stomach, liver, kidneys, &c.; those of the remaining two containing iron, and being used as a tonic. *Homburg hats* originated here. Pop. 14,344.

Home, Henry, a Scottish lawyer and author, born 1696, died 1782. He studied law at Edinburgh, and was called to the Bar in 1724. He soon acquired reputation by a number of publications on the civil and Scottish law. In 1752 he became a judge of session, and assumed the title of Lord Kames. In addition to his legal works he published *Essays on British Antiquities*; *Essays on the Principles of Morality and Natural Religion*, in which he advocated the doctrine of philosophical necessity; *Introduction to the Art of Thinking*; and his best-known work, *Elements* *of Criticism*, in which, discarding all arbitrary rules of literary composition, he endeavoured to establish a new theory on the principles of human nature. In 1776 he published the *Gentleman Farmer*, and in 1781 *Loose Thoughts on Education*.

Home, John, Scottish clergyman and dramatic poet, born at Leith 1722, died at Edinburgh 1808. He studied for the church, and was appointed to the parish of Athelstaneford, vacant by the death of Blair, author of *The Grave*. His tragedy of *Douglas* was performed at Edinburgh in 1756, and at Covent Garden (with Peg Woffington in the cast) in 1757, and attained a wonderful popularity. The production gave great offence to the Church as a body; the author was threatened with ecclesiastical censures, and in consequence resigned his living, and ever after acted and appeared as a layman. He retired into England, obtained the protection of the Earl of Bute, and received a considerable pension. His other plays, *The Siege of Aquileia*, *The Fatal Discovery*, *Alonzo*, and *Alfred*, are absolutely forgotten, a fate which their mediocrity deserves. His *History of the Rebellion of 1745–46* (4to) also disappointed public expectation.

Home Office, The, as it exists to-day, dates from 1782, when it was formed from the ‘ Southern ’ Secretaryship of State, which had, from 1688, controlled the relations of Great Britain with Ireland, the Colonies, and the countries of Southern Europe. The Home Office continued to be entrusted with Irish and colonial affairs until 1801, and it administered the militia up to the time of the Crimean War. At the present time the Secretary of State for the Home Department is charged with the maintenance of order and the repression of crime in England and Wales. In his hands lie the supervision and control of English and Welsh prisons and convict establishments; he is also responsible for the administration of the Factory Acts, the Coal and Metalliferous Mines Acts, Poor Law Acts, Reformatory and Industrial School Acts, Explosives Acts, Inebriates Acts, Vivisection Acts, Prevention of Cruelty to Children and to Animals Acts, the Burial Acts, and the Licensing Laws. Further, this minister, always a member of the Cabinet, is the proper channel for addresses to the Crown and the replies to such; and it is through him that the sovereign communicates with the people. Finally, it is on the ‘ advice ’ of the Home Secretary that the Crown exercises, or declines to exercise, its prerogative of remitting the death sentence; there being thus laid upon a single man a grave responsibility which many think would be better shared among several persons. The Home Secretary is assisted in his work by both permanent and parliamentary under-secretaries, numerous assistant secretaries, and an extensive staff of inspectors and other officials attached to the various departments under his control. The salary is £5000 a year, and the present (1922) holder of the office is the Rt. Hon. Edward Shortt, K.C., M.P.

Homer (Ὅμηρος), the name attached as that of their (traditionally blind) author to the two great Greek epics, the *Iliad* and the *Odyssey*, and also to certain minor poems, the *Homeric Hymns*, a collection of poems addressed to various divinities, the *Margites* (The Madman), which, from the fragments which remain, appears to have been a mock-heroic epic, another mock-heroic epic the *Batrachomyomachia* (The Battle of the Frogs and the Mice), and a collection of epics dealing with the Trojan War and known as the *Cyclic Poems*, of which only small fragments remain. These minor poems are of comparatively small account; their connection in authorship with the *Iliad* and *Odyssey* is, to say the least of it, very doubtful; and it is the two great epics which are here mainly to be considered.

The *Iliad* deals with an episode of the Trojan War, the wronging of Achilles, the greatest of the Greek warriors, by Agamemnon, the supreme leader of the host, in the matter of the captive maiden Briseis, the wrath which Achilles thereupon conceives, and the consequences and final appeasement of his wrath. The Greeks suffer disaster through his withdrawing himself from the fight; Patroclus, his bosom friend, is slain by the Trojan champion, Hector, son of Priam, the king; he is roused to slay Hector in revenge, and the poem ends with the ransoming of Hector's body by his father. The *Odyssey* tells of the wanderings and adventures of Odysseus (Ulysses) in the course of his return to Ithaca after the capture of Troy, and of what had meanwhile gone forward in his house, where Penelope, his wife, was besieged by suitors; and finally relates how Odysseus and his son Telemachus, whom he had left an infant when he set out for Troy, encountered and slew the suitors, and how husband and wife were reunited. The capture of Troy is incidentally related. The *Iliad* breaks off before that point is reached.

Herodotus, the historian, who flourished about 440 B.C., speaks of Homer as having lived about 400 years before himself; and for long a personal Homer, the author of all the poems above mentioned, appears to have been taken for granted, dates varying between limits not very far from each other being assigned to him, and seven cities contending for the honour of having been his birth-place. About the third or second century B.C. a school of Homeric critics, among whom the most eminent was Aristarchus, existed at Alexandria; and the result of their criticism was that the authorship of Homer was confined to the *Iliad* and the *Odyssey*, the other poems being regarded as not genuine. Among these critics, however, some appear to have gone a step further. A sect known as the Chorizontes (' Separators ') held that the *Iliad* alone was to be assigned to Homer, and that the *Odyssey* was the work of another author. Their views produced little or no effect.

There the ancient scrutiny of Homeric authorship may be said to have stopped; and it was not till what may almost be called our own time that the matter was reopened. Robert Wood in his *Essay on the Original Genius of Homer*, published in 1769, appears to have been the first fully to realize the importance of the question whether the art of writing was practised at a date to which the composition of the epics could be assigned. He answered this question in the negative; and this answer was the keystone of the theories of Friedrich August Wolf, who in his *Prolegomena ad Homerum*, published in 1795, maintained that poems forming the basis of the epics were put together from older pieces of various authorship by a poet of commanding genius whom he often calls ' Homer '; that, writing being unknown, or at any rate not yet employed for literary purposes at the time of the putting together of the poems, the poems were for long transmitted by memory and oral recitation; that in the course of transmission alterations and additions, deliberate or accidental, were made; that the poems were not written down till about 550 B.C., and after being written down suffered still further changes deliberately made by ' revisers ' or critics until they attained their present state; and that the artistic unity seen in the epics as we possess them is due not so much to ' Homer ' as to later artificial treatment. In asserting that the epics were not written down before 550 B.C., Wolf chiefly relied on a doubtful and vague tradition to the effect that a definite text was first settled from scattered materials and committed to writing at Athens in the time of the tyrant Pisistratus (died 527 B.C.). This tradition occurs first in Cicero (106–43 B.C.), and is found in no Greek author before Pausanias (*floruit c.* 180 B.C.); and the evidence for it is inconclusive, though, of course, rejection of the tradition does not necessarily imply rejection of Wolf's thesis as to the date at which the use of writing might be presumed. J. G. J. Hermann (1772–1848) developed Wolf's views with a tendency to make 'Homer' more influential than Wolf had done. He held that the primitive poet had settled the main form and the limits of the poems, and that those who came after him confined themselves to retouching, recasting, and engrafting new work, without seriously affecting the main features of that on which they worked. G. W. Nitzsch (1790–1861) gives 'Homer' still further influence, conceiving that, working on old materials (as great poets so often have done), he made them his own, and produced the epics substantially as we have them. On the other hand, K. K. F. W. Lachmann (1793–1851) tended to minimize the influence of ' Homer '. He split up the *Iliad* into no fewer than eighteen separate and originally independent ' lays ' by various hands strung together by the primitive poet. He was followed on similar lines by others, such as Köchly; but these dissectors do not agree as to the points of dissection, and for the most part each produces a different set of ' lays '. George Grote (1794–1871), while largely agreeing with Nitzsch, conceived the *Iliad* as having been originally a comparatively short poem, an *Achilleid*, dealing solely with the wrath of Achilles, and as having been expanded to its present dimensions by a later poet whom he regarded as the true Homer. Other scholars, such as W. Christ, W. D. Geddes, and Dr. Walter Leaf, have each in his own way continued the analysis of the *Iliad* on the general lines of Lachmann; but other scholars, such as the late Andrew Lang, have strenuously maintained that the epics were composed substantially in their present form by a single poet, though they, of course, admit that minor changes in the text must have taken place in the course of the long transmission. It will be noticed that the scholars who question the unity of authorship have devoted their chief attention to the *Iliad*, which from the nature of its plan is of comparatively loose structure. Attempts have been made to split up the *Odyssey* also; but these cannot be said to have been successful. The plot of the *Odyssey* is, in fact, of the most ingenious and closely-knit construction; and while it is, of course, possible to attribute different parts of the poem to different hands, just as we might deal with a modern novel in which plot and subplot are interwoven, it is on the face of it far more probable that the cunningly-contrived structure is the work of one brain. There is, too, another consideration which does not seem to have been fully kept in view. There is no good reason to suppose that the *Cyclic Poems*, of which mention is made in the beginning of this article, are of later, or at any rate of much later, date than the *Iliad* and the *Odyssey*. Now these epics were evidently, at least in some cases, comparable in length with the two great epics, and must reasonably be considered to have been composed, and, as they were known down to comparatively late times, to have been transmitted, much as these were. All the epics must be treated in the same way; and treatment which is avowedly exceptional becomes increasingly open to objection as it is more widely applied.

Such, in brief, was the state of the Homeric question up to the time of the discoveries made in Crete from 1900 onwards by Sir Arthur Evans and his followers. These discoveries have completely changed our conceptions of the early history of the Ægean area. Formerly the men of the age to which the epics were assigned were regarded as more or less rude, as standing at the beginnings of civilization. We now know that they looked back over a space of civilization at any rate as great as the space which lies between us and them. In Wolf's theory the fundamental proposition was his denial that the literary use of writing could be assumed for any age to which the epics could be assigned. We now know that the art of writing was practised long before any date which can possibly be fixed for them; and it may confidently be assumed that if at the place and date of their composition the art of writing was felt, as it certainly would be, to be useful for literary purposes, it would be practised. It may, in fact, safely be said that if Wolf could have viewed Homer as we can view him, his theories, and the theories of those who followed him, would have been entirely different. He could point to the external evidence, such as it then was, as supporting him, and could invoke it in aid of his attempt to assign to the epics from the internal evidence an origin in conflict with all analogy. Now the external evidence strongly supports those who regard the epics as having been produced as all other great epics have been produced, as having been the work of a conscious artist working more or less in the manner predicated by Nitzsch on materials furnished to him by predecessors. There seems to be no serious objection to our supposing, in one of the cities of Asia Minor (say Smyrna), somewhere about 800 or 700 B.C., the existence of a great poet named Homer writing his epics in a period of poetical activity in the midst of fellow-poets whose works are partially represented by the *Cyclic Poems*. So far as extant remains show, the poets of the age would seem to have taken their themes from stories about or connected with the Trojan War (which may be regarded as actually historical); but, of course, many poems on other themes may have perished. It is perhaps not entirely fanciful to picture a period of epic activity at Smyrna not unlike the period of dramatic activity in Elizabethan London. At any rate, opinion seems now to be moving in the direction of a personal Homer composing and writing down his epics substantially in the form in which we have them, though the text must from obvious causes have suffered a certain measure of corruption, and must have been added to or mutilated here and there by editors or copyists. But not a few still maintain the older views.

Our text of Homer rests on a large number of manuscripts dating from the tenth century A.D. onwards. These manuscripts differ remarkably little among each other; and there is good reason to suppose that the text which they furnish approximates very closely to that current in Athens in the time of Pericles. Beyond that the stream of testimony dries up; and we cannot tell how nearly that text approximated to the original text. That there were differences is certain, if only on account of the change in the alphabet which in the meantime took place.

The best modern text of the *Iliad* and *Odyssey* is that published at Oxford by the Clarendon Press in its series of classical texts. For English readers the best editions with commentaries are the *Iliad* by Dr. Leaf, second edition, 2 vols., 1900–2, and the school edition of the *Iliad* by D. B. Monro, also in 2 vols., originally published 1884–8; the *Odyssey*, books i–xii, by W. Walter Merry and James Riddell, second edition 1886, and the *Odyssey*, books xiii to xxiv, by D. B. Monro, 1901. The best English prose translations are the translation of the *Iliad* by Lang, Leaf, and Myers, and that of the *Odyssey* by Butcher and Lang. Translations in verse are numerous. That of both epics by Pope, though it is not at all like Homer, has at any rate the merit of being readable, a characteristic shared by few or none of the others. Jebb's *Homer: an Introduction to the Iliad and the Odyssey* should be referred to.

Home Rule, a term invented in 1873 to designate the Irish demand for self-government. The struggle for self-determination on the part of Ireland ranged over a period of seven and a half centuries. From 1172, when Henry II received the homage of the chief Irish kings at Dublin, a bitter feud was waged with England. The story is one of rebellion, repression, and fierce resolve, which, in the final fifty years, almost dominated English political life. The country was not conquered at the outset, and guerrilla warfare ended in some form of independence during the Wars of the Roses. In 1495 Poynings' Act was passed, making Irish laws dependent on the sanction of the King and the English Privy Council. But revolt continued, the 'plantation' of the country by English and Scottish settlers was not carried out on a large enough scale, and the efforts to introduce Protestantism after the Reformation only led to a new cause of resistance. Cromwell and his son-in-law, Ireton, subjugated the land between 1649 and 1656, when many Irish families were forcibly removed beyond the Shannon. The Irish rallied to the cause of James II at the English Revolution of 1688, but they were defeated at the battle of the Boyne in 1690, and the history of the subsequent century is one of penal laws against the Roman Catholics, who were also excluded from the Irish (Grattan's) Parliament, which existed from 1782 to 1800. A rebellion in 1798 was not suppressed until 1800, and on the first day of the following year the union with Britain was effected. By this Ireland was united to Great Britain, and was given 100 seats in the House of Commons and 34 in the House of Lords. Almost immediately, however, the struggle for separation was resumed. After Catholic emancipation a 'Young Ireland' movement was inaugurated, but famine depopulated the land, discontent grew, and armed risings followed. Then came the Fenian movement, with secret societies, riots, and bloodshed; Fenians in the United States made raids into Canada, there were outrages in England, and wholesale arrests. In 1870 Isaac Butt, the leader of the Irish Party in the House of Commons, inaugurated the Home Rule movement. A motion in its favour, brought up at Westminster in 1874, was rejected by 458 to 61. Charles Stewart Parnell, who succeeded Butt as leader of the Irish Nationalists, forced the question to the front by persistent Fabian tactics in Parliament, while outside the campaign of outrage was intensified. The Irish 'Invincibles' assassinated Lord Frederick Cavendish, the Irish Secretary, and T. H. Burke, the Under-Secretary, in Phœnix Park, Dublin, in 1882; the Clan-na-Gael Society tried to terrorize the British people by dynamite outrages, which included an attempt to blow up the Houses of Parliament and the Tower of London in Jan. 1885; there were moonlighting crimes, cattle maiming, boycotting, a no-rent campaign, and a general state of unrest in Ireland. Coercion Acts were passed after acrimonious debates in which Irish members were suspended. Gladstone introduced the first Home Rule Bill in 1886. It was defeated, and completely altered British party politics by smashing up the Liberal Party. Joseph Chamberlain, Lord Hartington (afterwards Duke of Devonshire), and other prominent Liberals seceded and formed the Liberal Unionist Party, which in due course fused with the Conservatives and became the Unionist Party. With the Unionists in power, Arthur Balfour, as Irish Secretary, was given a free hand to restore order in Ireland. An unexpected new complication was a divorce suit in which Parnell was the co-respondent. The Nationalist Party was split in twain, 30 remaining faithful to Parnell and 54 forming themselves into an Anti-Parnellite group. Parnell died in 1891, and was succeeded by John Redmond. Two years later Gladstone was returned to power again, and in 1893 introduced a second Home Rule Bill, which differed from the previous measure by retaining eighty Irish members in the Imperial Parliament. It passed the Commons, but was rejected by the Lords by a majority of 378. Following this, Home Rule dropped into the background. Gladstone died, the Liberals were out of office for over ten years, the Boer War monopolized attention, and following it Chamberlain introduced his policy of Tariff Reform, which became the dominating political question. The Liberals were returned to power again in 1906 when Ireland was peaceful and prosperous, but it was not until 1910 that Home Rule came to the fore again, as there was a sufficient majority without the Nationalist vote. This time the policy was to deal with the Lords' veto which blocked the passing of the measure, and after a bitter struggle the Peers were compelled to pass the Parliament Act of 1911. Under this their veto is limited to two sessions; in the third they are ignored if the Commons pass a measure the third time. A new Home Rule Bill was introduced by Mr. Asquith, the Premier, in 1912, and immediately the opposition of Ulster, which is mainly Protestant, took definite form. A covenant of resistance was signed, among others, by Sir Edward (afterwards Lord) Carson, and prominent Unionists, and a volunteer force was raised. The Nationalists also recruited volunteers, and there was gun-running by both parties. In 1914, when, after a third passing by the Commons, the Home Rule Bill was bound to become law, the prospect of civil war in Ireland was serious.

The European War gave the Home Rule movement its most dramatic and tragic turn. The Bill was passed with a proviso that it was not to come into force until after the war. On Easter Monday, 1916, at a critical stage in the war, rebellion broke out in Dublin. It was organized by the Sinn Fein ('Ourselves Alone') Party and assisted by Germany, who sent Sir Roger Casement, an ex-British consul, who had tried to raise a German-Irish regiment from among British war prisoners in Germany, to land arms in Ireland. Casement was arrested on landing, tried, and hanged; the rebellion, which had proclaimed a republic, was suppressed in a week, and the leaders tried by court-martial and shot. Sinn Fein, however, continued to flourish, the passing of an Irish Conscription Bill in 1918 was bitterly resented, and at the general election at the end of that year, after the Armistice, a totally new situation was created by the election of seventy-three Sinn Feiners who refused to sit in the British House of Commons, constituted themselves an Irish Parliament under the title of Dail Eireann, and declared Ireland an independent republic with De Valera as president. A terrible campaign of outrage and murder followed; the country was plunged into virtual civil war. To meet the situation, the Home Rule Act of 1914 was repealed in 1920, and a new Act passed, giving Ireland two Parliaments, one for the south and west and the other for the six northern counties of Ulster, where the hostility to Home Rule and an All-Ireland Parliament was intensified. The campaign of outrage and assassination was at its height when King George V and the Queen visited Belfast to open the Northern Parliament on 22nd June, 1921. In his speech, the King made a solemn appeal for conciliation, and that marked the great turning-point in Irish history. David Lloyd George, the Prime Minister, issued invitations to a conference, a truce was declared, and, after preliminary disappointments, discussion between the Sinn Fein leaders and representatives of the British Government began in London on 11th Oct., 1921. Proposals were rejected by each side, Sinn Fein insisting on an All-Irish Parliament, and Sir James Craig, the Ulster Premier, refusing it. Just when it seemed that the negotiations would prove futile, an agreement was reached at the Premier's residence, 10 Downing Street, London, just before 3 a.m. on Tuesday, 6th Dec., 1921. This made Ireland a free state on terms of Dominion Home Rule, leaving Ulster the option of remaining out if she preferred to do so. A week later a special session of Parliament approved the treaty with only 58 dissentients in the Commons and 47 in the Lords. After several days of acrimonious debate in which much Celtic eloquence was heard, An Dail Eireann ratified the treaty on Saturday, 7th Jan., 1922, by the narrow majority of 7 (64 to 57). The Sinn Fein party was split in two, one section under Mr. Griffith, who was elected President of Dail Eireann on 10th Jan., 1922, being in favour of the Irish Free State, and the other section under Mr. De Valera being content with nothing less than a republic and complete separation from Great Britain. The latter party has declared that " the fight must go on ".—BIBLIOGRAPHY: A. J. Balfour, *Aspects of Home Rule*; E. Childers, *The Framework of Home Rule*; F. Hackett, *Ireland: A Study in Nationalism*; M. Macdonagh, *The Home Rule Movement*; J. E. Redmond, *Home Rule*.

Homici'dal Mania, a term applied to the action of an insane person who displays a sudden irresistible impulse to destroy life. It is often independent of hatred towards the victim, but as a rule it is due to a mental conflict which destroys the patient's power of controlling his impulses. Hence some trivial or imagined insult may be sufficient to excite the patient to action.

Homicide (Lat. *homo*, man, and *cædere*, to kill), the killing of one man or human being by another. In law, homicide is of three kinds—*justifiable*, *excusable*, and *felonious*; *justifiable*, when it proceeds from unavoidable necessity, as where the proper officer inflicts capital punishment, where a person is killed to prevent him committing a forcible and felonious crime, where an officer of justice kills an offender who assaults or resists him and who cannot otherwise be captured, or where persons are killed in the dispersion of rebellious or riotous assemblies; *excusable*, when it happens from misadventure, as where a man in doing a lawful act by accident and without negligence kills another, or in self-defence, as where a man kills another in defence of the life of himself, his wife, children, parent, servant, &c.; *felonious*, when it proceeds from malice, or is done in the prosecution of some unlawful act, or in a sudden passion, or without justification or excuse. Self-murder also is felonious homicide. Felonious homicide comprehends murder and manslaughter. In Scots law manslaughter gets the name of *culpable homicide*. See *Manslaughter*; *Murder*.—Cf. Stephen, *History of the Criminal Law of England*.

Hom'ildon, Battle of, a battle fought in 1402 between the Scots under Archibald, Earl of Douglas, and an English force under Hotspur and the Earl of March, at Homildon Hill, near Wooler. The Scots were utterly defeated.

Homilet'ics, the art of preaching; that branch of practical theology which teaches the principles of adapting the discourses of the pulpit to the spiritual benefit of the hearers, and the best methods which ministers of the gospel should pursue for instructing their hearers by their doctrines and example. The earliest Christian writer on homiletics is St. Augustine (*De Doctrina Christiana*).

Homily, a discourse or sermon read or pronounced to an audience on some subject of religion; a discourse pronounced in the church by the minister to the congregation. The ancient homily was sometimes simply a conversation, the prelate talking to the people and interrogating them, and they in turn talking to and interrogating him. In modern use a homily differs but little from an ordinary sermon, the idea of simplicity, however, being always attached to it. The earliest existing examples of the homily are those of Origen in the third century. In the schools of Alexandria and Antioch this form of discourse was sedulously cultivated, and Clement of Alexandria, St. Dionysius, and Gregory Thaumaturgus are among the names most eminent in this department. It was in later centuries, however, and in the hands of Athanasius, Gregory of Nyssa, and Gregory of Nazianzus, Basil, Cyril of Jerusalem, and Cyril of Alexandria, and especially of Chrysostom, that the homily reached its highest excellence. Augustine and Gregory the Great were among the Western composers of homilies. In the Church of England, after the Reformation, two official books of homilies were issued. These were called *The First* and *Second Books of Homilies*, and the former. ascribed to Cranmer, appeared in 1547;

the latter, said to be by Jewell, in 1563. They were originally meant to be read by those of the inferior clergy who were not qualified to compose discourses themselves.

Homocer'cal (Gr. *homos*, same, *kerkos*, tail), a term applied in the case of bony fishes which have externally symmetrical tails. See *Heterocercal.*

Homœop'athy, a word of Greek origin, meaning, literally, ' like suffering '. A system of therapeutics built upon the law that likes are cured by likes, discovered by Hahnemann, and elaborated in his various works, the chief of which are *Organon of Medicine* (Everyman's Library) and *Chronic Diseases.* He was famous as a linguist and translator, a great chemist, discovered soluble mercury, and was the first physician to treat lunatics on the humane non-restraint principle.

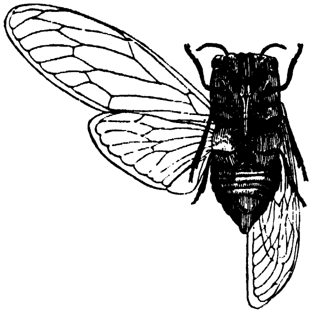
The law of similars in practice demands no experimentation on the sick, but detailed and careful provings of drugs on the healthy. A drug given to persons in health consistently produces a sickness peculiar to itself. The totality of the symptoms produced gives the complete drug-disease picture, and the similarity between the drug picture and the symptoms of the sick individual determines its applicability as the curative remedy. The closer the similarity between the drug and disease pictures, the greater the sensitiveness of the patient's reaction to the remedy. The virus gives the outline, but the individual creates the colouring of the disease picture. In the homœopathic system the sick individual is treated, and not the disease as labelled by the ' authority of the day '. Individualization is the key-note to successful homœopathy. To sift out the uncommon and peculiar symptoms that are part of the personal recuperative effort of the patient from the symptoms that belong to the nature of the disease is to individualize the sick person and the similar drug. Hahnemann says: " Without the most minute individualization, homœopathy is not conceivable ". It is the reaction of the drug that is desired, and, consequently, the minuter the dose which will produce the desired effect without first aggravating the trouble, the speedier the cure. Hahnemann discovered that by repeated triturations and succussions the power of the remedy was enhanced. These attenuations he called ' potencies '. The greater the subdivision the more the potency increases, and the higher the potency the deeper the reaction. Even an inert substance like silica, treated thus and given to the healthy, produces symptoms of sickness, and is proven as a valuable remedy. Science verifies that a substance such as gold can be subdivided and a colloid produced. Such colloids have a profound effect on the vital economy. Physics and physiological chemistry are proving the great power of the minute. Physics has passed from mass to molecule, from molecule to atom, from atom to electron, and powers undreamed of before are disclosed. Homœopathic remedies are not mere dilutions but potentizations. Homœopathy creates a new orientation in medicine.

Homoiousians, a sect of Arians, followers of Eusebius, who maintained that the nature of Christ is not the same with, but only similar to (Gr. *homoios*, like), that of the Father, as distinguished from the Homoousians, who maintained that he was of the same nature.

Homoousians (Gr. *homos*, same, *ousia*, being, nature), the orthodox party in the Church during the great controversy upon the nature of Christ in the fourth century, who maintained that the nature of the Father and the Son is the same, in opposition to the *Homoiousians*, who held that their natures were only similar.

Homoplasy, in biology, similar structural characters presented by different groups of organisms which have been adapted to the same kind of environment, and which have been independently acquired, so that they do not prove relationship. A great many desert plants, for instance, are markedly spiny and devoid of thin flattened leaves. Aquatic animals, belonging to diverse groups, are often of similar shape; and creatures that live in thick undergrowth tend to be elongated and cylindrical, with limbs reduced in size or absent, e.g. snakes and snake-like lizards. Such resemblances are often expressed by using the term ' convergence of characters '.

Homop'tera, one of the sections into which the order of hemipterous insects has been divided, the other section being the Heteroptera. The insects of this section have the wing-covers generally deflexed, of the same consistence throughout, the antennæ mostly short and terminated by a bristle, and the body convex and thick. To this



Homoptera. One of the Cicadas (under side) section belong the aphides, cicadas, lantern-flies, &c.

Homotax'y, in geology, the sequence of fossil faunas in the same order in widely separated regions of the globe. William Smith (see *Geology*) showed how the position of a system of rocks in the great stratigraphical succession could be determined by the 'organized fossils' that it contained. The verification of his observations beyond his special field, Great Britain, led to a general recognition of homotaxy. It is not now contended that the life-forms characterizing a geological system were changed for those of the succeeding system simultaneously over the whole earth; but, in dealing with such vast periods of time as are required for the building up of a stratigraphical system, its upper and lower boundaries over very wide areas may be fairly regarded as homotaxial.

Honan', an inland province of China, named after a city of the same name, now little but a scene of ruins. The province has an area of 67,940 sq. miles. It is generally level, and is watered by the Hoang-ho and its affluents. The soil is fertile and carefully cultivated; the forests in the west supply timber; and mines yield tutenag or Chinese copper, cinnabar, and mica. Honan suffered severely from the inundation of the Hoang-ho in 1887; capital, Kai-fung. Pop. 22,375,000.

Honawar', a seaport and chief town of subdivision of the same name, Bombay, on an estuary into which the Gersoppa River falls. It has an important and growing coasting trade. Pop. 7320.

Hondo, the name given by the Japanese to the chief island in their empire; the official name is Honshiu. In many geographical works Nippon or Niphon is the distinctive appellation of this island, but by the Japanese themselves that name is applied to the whole country. See *Japan*.

Hondu'ras, a republican state of Central America; area, 44,275 sq. miles. Its surface is hilly with numerous fertile valleys. Its mineral wealth is very considerable, and includes gold, silver, lead, and copper. The chief rivers are the Chamelicón, Ulua, and Aguan, flowing to the Caribbean Sea, and the Choluteca, an affluent of the Pacific. There are extensive forests abounding in fine timber. The principal cultivated productions are bananas (the chief export), maize, beans, some wheat, rice, tobacco, &c. The capital is Tegucigalpa; the principal ports are Truxillo and La Ceiba on the Caribbean Sea, and Amapala on the Pacific. The Constitution gives the legislative power to a Congress of Deputies; the executive authority rests in the President and a Council. The republic declared war on Germany in July, 1918. President Rafael Lopez Gutierrez was elected in 1920. The resources of the country are undeveloped, and the finances in a disordered state. More roads and railways are greatly required, although slow improvements are beginning to be made. Pop. (1920), 637,114.

Honduras, Bay of, a wide inlet of the Caribbean Sea, having on the south Guatemala and Honduras, and on the west British Honduras and Yucatan. Along its shores are the Islands of Bonaca, Ruatan, Utila, Turneffe, and numerous islets and reefs called cays.

Honduras, British, or **Belize**, a British Crown colony of Central America, having north and west, Yucatan; west and south, Guatemala; and east, the Bay of Honduras. Area, 8592 sq. miles. The coast is generally low and swampy, but the land rises towards the interior, and in some parts may be called mountainous. The mountains, and the wide valleys between them, are covered with extensive forests of the finest timber, including cedars, pines, iron-wood, logwood, braziletto, and mahogany. Sugar-cane, coffee, bananas, coco-nut, tobacco, &c., are cultivated; and the exports include mahogany, logwood, bananas, and other fruits. The climate is fairly healthy. Since 1884 the government has been administered as in a Crown colony under the presidency of a Governor. The capital is Belize or Balize. Honduras was transferred by Spain to England by treaty in 1670, but at different times its occupation was contested by the Spaniards till 1783, since which period it has remained quietly in the possession of Great Britain. The population is composed chiefly of negroes and Caribs from the West Indies, who were first brought to the country as slaves. Pop. (1919), 43,586, including about 600 whites.—Cf. A. R. Gibbs, *History of British Honduras*.

Hone, William, English antiquary, born 1780, died 1842. He began life in a law office, and became imbued with free-thinking opinions. In 1800 he abandoned the law and made ventures as a writer, bookseller, and publisher, which were all failures. In 1817 he was prosecuted by Government for the publication of alleged irreverent parodies and lampoons, when he defended himself with great acuteness, and was acquitted. He subsequently had a large sum subscribed for him as a champion of the freedom of the press. He gradually abandoned free-thought and the writing of satires for religion and antiquarianism. His chief publications are: *The Political House that Jack built* (1819), *The Man in the Moon* (1820), *The Every-day Book* (1826), *Table-book* (1827–8), and *Year Book* (1829), perfect mines of antiquarian lore.

Hone, the name given to several varieties of slaty stones employed in whetting knives, razors, or other edge-tools. They are usually pieces of hard close-grained clay-slate, containing minute particles of quartz, with a uniform consistence. The best-known varieties are the Ayr stone, so called from being found in the River Ayr, in Scotland; the Charnley Forest stone, found in Leicestershire; the German hone, the Canada oil-stone, and the Turkey oil-stone.

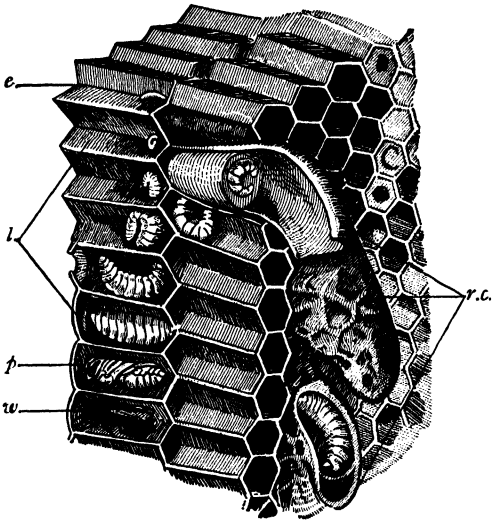
Honey, a vegetable product, with saccharine properties, collected by bees from the blossoms of flowers, and deposited in the cells of their combs. The best is clear and transparent, and solidifies when kept for some time into a granular, white mass. Some varieties of it are dark-yellow or brownish in colour. Spring honey is considered better than summer honey; and the latter than that of autumn. *Virgin* honey is taken from hives in which the bees have never swarmed, and it is of a white colour. *Yellow* honey is extracted from all sorts of combs. The flavour of honey largely depends on the plants from which it is collected. Honey is obtained in large quantities in many countries, partly from wild bees, but chiefly from those kept in hives. In addition to its ordinary domestic uses, it is employed medicinally as a promoter of expectoration, to sweeten certain medicines, to make a gargle with vinegar, &c. It is also used in making mead. Honey was held in very high esteem and was valued by the ancients. The Hebrews defined the Promised Land as " a land flowing with milk and honey ". It was used for sweetening purposes throughout the Mediterranean area until the introduction of sugar. The ancient Egyptians made sweet beer from honey, and also used it for embalming the dead. Honey was also used as an article of barter in Ceylon and East Africa.

Honey-ant, an ant, species of Myrmecocystus, inhabiting the United States and Mexico, and living in communities in subterranean galleries. In summer a certain number of individuals are fed by the workers with a kind of honey obtained from oak-galls, until their abdomens become so distended as to appear like small pellucid grapes. Later in the season, when food is scarce, these ' honey-pots ' are devoured by the others, and they are also dug up and eaten by the inhabitants of the country.

Honey-comb, a waxen cellular structure formed by bees for storage of honey and eggs. The wax is secreted by the insect in the form of small and thin oval scales in the folds of the abdomen. The comb is composed of a number of cells, most of them exactly hexagonal, and arranged in two layers placed end to end, the openings of the layers being in opposite directions. The comb is placed vertically, the cells being therefore horizontal. The sides of the cells are very thin, and yet the whole structure is of considerable strength. The cells are closed by waxen lids after honey has been stored or eggs deposited in them. Queens are reared in irregular acorn-shaped queen-cells.

Honey-dew, a sweet saccharine substance found on the leaves of trees and other plants in small drops like dew, but in reality deposited by aphides. Different kinds of manna are the dried honey-dew or saccharine exudations of certain plants.

Honey-eater, the name given to a number of perching birds forming the family Meliphagidæ, and native to the Australian region. They feed on fruit, buds, and the nectar of flowers. They have long curved sharp bills, with tongues terminating in a pencil of delicate filaments, to enable them the better to extract the juices of flowers. Among the species are the wattled honey-eater (*Anthochæra mellivora*), soldier bird (*Myzomela sanguinolenta*), cobbler's awl (species of Acanthorhynchus), friar birds (species of Philemon), and bell birds (species of Anthornis and Manorhinus).



Honey-comb

Comb with brood. On left development of a worker: egg (*e*) larvæ (*l*), pupa (*p*), perfect insect (*w*). On right are seen royal cells (*r.c.*) the middle one unopened.

Honey-guide, a name given to the cuckoos of the genera Indicator and Prodotiscus, which, by their motions and cries, conduct persons to the nests of wild honey-bees. They are natives of South Africa and South Asia, and with the barbets (which also range into tropical America) make up the family Capitonidæ, allied to toucans and woodpeckers.

Honey-locust, Sweet Locust, or **Black Locust** (*Gleditschia triacanthos*), a forest tree belonging to the United States, nat. ord. Leguminosæ. The leaves are pinnated, divided into numerous small leaflets, and the foliage has a light and elegant appearance; the flowers are greenish, and are succeeded by long, often twisted pods, containing large brown seeds, enveloped in a sweet pulp. This tree is especially remarkable for its formidable thorns, on which account it has been recommended for hedges. The *G. monosperma*, a tree resembling the last in general appearance, grows in swamps in Illinois and south-westward. The wood is inferior in quality.

Honeysuckle, or **Woodbine,** genus Lonicĕra of Linnæus, nat. ord. Caprifoliaceæ. The common honeysuckle of Britain, *L. periclymĕnum*, a twining shrub, with distinct leaves and red berries, is indigenous in Great Britain; but two others have been naturalized, *L. caprifolium*, distinguished by its upper leaves being united in a cup; and *L. xylosteum*, with small, yellowish, scentless flowers, and scarlet berries. *L. sempervirens* (trumpet-honeysuckle) is also cultivated in Britain on account of the beauty of its flowers. The honeysuckle family is represented in North America by nine different species. *Australian honeysuckle* is a name given to *Banksia australis* and other species of the Protea family, from their flowers being filled with a sweet liquid.

Honfleur (oṇ-fleur), a seaport of France, department of Calvados, on the estuary of the Seine. It is a town of old buildings and narrow streets, and although the rise of Havre has injured its commerce, it still has a trade in agricultural and dairy produce, and some manufactures in connection with shipping and fisheries. On the hill above the town is the chapel of Notre Dame de Grâce, much frequented by sailors and filled with their votive offerings. Honfleur was long in possession of the English, and was of considerable strategical importance during the Hundred Years' War. Pop. 9298.

Hong-Kong, an island off the south-east coast of China, belonging to the British, at the mouth of the estuary that leads to Canton, from which it is distant 75 miles. It is about 10 miles in extreme length, and 7½ miles in extreme breadth, separated from the mainland by a narrow strait, and with Kowloon on the mainland forms a Crown colony, area 391 sq. miles. The island consists almost entirely of barren rocks, which rise to heights of 1000 to 2000 feet. Good water is abundant, and much vegetation has been provided artificially. On the north side of the island, on a splendid harbour, is Victoria, stretching for 4 miles between the sea and the hills, a well-constructed town. It has a cathedral, a bishop's palace, a Government house, court house, &c.; while handsome residences of the merchants are scattered about the town and its suburbs. Hong-Kong is a great entrepôt for the foreign commerce of China; the tonnage entered and cleared annually is about 36,000,000. It is a free port, and a station of the British fleet. The revenue is derived from licences to sell opium and spirits; land sales, rates, taxes, &c. Large numbers of Chinese are engaged in trade and industries, but the island itself produces comparatively little. Sugar-refining and cotton-spinning are industries. The foreign commerce is carried on partly with Great Britain, partly with India, Japan, America, and other countries. Of goods imported direct from Britain, cotton goods form by far the largest item, others being woollens and metals; the exports to Britain are chiefly silks, tea, and hemp. The currency consists chiefly of silver dollars. Hong-Kong was ceded to Britain in 1842; some 356 sq. miles additional were leased in 1898. The University of Hong-Kong, founded in 1911, was opened in March, 1912. At the end of 1916 a scheme was started for reclaiming 12 million sq. feet of land from the sea in Kowloon Bay, and erecting a model town there. The total pop. was estimated in 1919 at 598,100, more than nine-tenths being Chinese, and over 13,000 whites.—Cf. E. J. Eitel, *Europe in China.*

Hon'iton, a town of England, in Devonshire, on the Otter, long celebrated for the manufacture of a special variety of lace. It was a parliamentary borough till 1868, and now gives name to a parliamentary division of the county. Pop. 3090.

Honolu'lu, the capital of the Hawaiian or Sandwich Islands, on the Island of Oahu, annexed in 1898 by the United States. It is electrically lighted, and has a tramway system. There is a fine natural harbour, very much improved, and now admitting the largest vessels afloat. Pop. (1920), 83,327.

Honorius, Flavius, son of Theodosius the Great, born A.D. 384, died 423. After the division of the empire, A.D. 395, Honorius received the western half, but, on account of his youth, Stilicho was appointed his guardian. The principal events of his reign are the adoption of rigorous measures against paganism in 399; the invasion by Alaric in 400–403; and another irruption of barbarians under Rhadagaisus, 405–406. Both invasions were repelled by Stilicho, who was assassinated at Ravenna in 408. Alaric marched on Rome and plundered it in 409, while Honorius shut himself up in Ravenna. Some of the finest provinces of the empire, Spain, Gaul, and Pannonia, were lost in this reign.

Honourable, Right Honourable, and **Most Honourable,** titles given in the United Kingdom to peers, their families, and certain public functionaries. Marquesses are styled 'Most Honourable', Earls, Viscounts, Barons, and Privy Councillors 'Right Honourable'. 'Honourable' is the courtesy title of the younger sons of earls and all the children of viscounts and barons, as well as of Maids of Honour and Judges of the High Court. In America the Governors of states, judges, members of Congress, and others holding offices of dignity and trust, are styled ' honourable '.

Honours, Military, compliments or salutes paid by troops to royalty, officers of rank, &c., or given at funerals to all grades of the army.—*Honours of War* are stipulated terms granted to a garrison surrendering, in consideration of a brave defence, &c. Sometimes the vanquished are allowed to march out with their arms, drums beating, and colours flying; or they may be permitted to deposit their arms and stores at a certain spot, and return to their own country on parole.

Honvéd, the name applied to the Hungarian national champions, under the earlier kings. The word disappeared afterwards, but was revived again in 1848, when it was applied to the patriotic army during the war with Austria. It was afterwards applied to the Hungarian militia.

Hoobly, or **Hubli**, a town of India, in Dhárwár district, Bombay Presidency, a great centre of the cotton trade. Pop. 61,400.

Hooch, or **Hoogh** (hōh), Pieter de, Dutch genre painter, born at Rotterdam about 1632, died about 1681. He was peculiarly successful in depicting scenes, illuminated by sunlight, of Dutch domestic life. His earlier work, influenced by Rembrandt's first manner, is remarkable for its harmonious, rich colour, and puts him in the front rank of the smaller Dutch masters. His later work is more mechanical and mannered. He produced comparatively little work, but is well represented in the National Gallery and the Wallace Collection.

Hood, Alexander, Viscount Bridport, brother of Samuel, Viscount Hood, born 1727, died 1814, was also an admiral. He commanded under Lord Howe in the Channel Fleet in 1794; defeated the French off L'Orient, 1795; and was created Viscount Bridport, 1801.

Hood, Robin, English outlaw and legendary hero. The earliest allusion to Robin Hood is to be found in Passus V of *Piers the Plowman* (B text), which was written about 1377. A large number of old ballads deal with the Robin Hood legend; most of these ballads date from the fifteenth century. There are three different theories advanced to explain the origin of the Robin Hood cycle of ballads: (1) Robin Hood was a real man, the greatest of outlaws. He may have lived in the reign of Edward II, and been an adherent of Thomas, Earl of Lancaster, in the insurrection of 1322. (2) Robin Hood is the central personage of a sun-myth, or is to be identified with the Teutonic god Woden. (3) Robin Hood was originally the name given to a mythical forest elf (cf. Robin Goodfellow), and then given, like the Irish Rory o' the Hills, as a generic name to any outlaw chief who lived in the forest and defied the unpopular game laws. The last of these three theories is the most probable. A good deal of research into records has failed to bring to light any evidence that Robin Hood was a real historical person. Nor can much be said for the theory that he is to be identified with the sun or with Woden. It is much more likely that the name was given to a succession of captains of outlaws; one of them, perhaps the earliest, may have been an outstanding man, and in that sense there may have been a real Robin Hood.

The Robin Hood cycle is very closely connected with Sherwood Forest and with Nottingham. Adam Bell, Clym of the Clough, and William of Cloudislee performed in Cumberland feats similar to those of Robin Hood. The cycle of ballads grew and grew; Robin's company originally contained Little John, Much the miller's son, William Scathlock, and others; in the early sixteenth century Friar Tuck was added to the company, while a love-interest was supplied by Maid Marian. By a later sophistication Robin Hood was represented as being the Earl of Huntingdon in disguise. In those days a title was an almost essential adjunct to a hero. The later ballads have not the freshness and charm of the earlier ones.

Robin Hood was essentially the hero of the yeoman class, as King Arthur was that of the upper classes. He was a typical middle-class Englishman, an unerring marksman, an expert with the quarter-staff, and he had a rough, boisterous sense of humour. Above all he defied the oppressive forest-laws, as every middle-class Englishman wished to do, and he aided in the redistribution of wealth, which every middle-class Englishman wished to see redistributed.

The Robin Hood ballads are among the best of their kind. They are redolent of the greenwood, and of careless, happy life in the country. It is always the month of May in the ballads, and the freshness of a May morning seems to pervade them. They have given pleasure to innumerable people, especially boys. They have inspired many poets, as Drayton, Jonson, and Tennyson, and some prose writers, as Scott and Thomas Love Peacock. They appeal straight to the spirit of youth and the love of open-air adventure that lives in all of us, even in the most elderly city-dweller.—BIBLIOGRAPHY: J. Hunter, *Great Hero of the Ancient Minstrelsy of England, Robin Hood*; F. J. Child, *English and Scottish Popular Ballads*; J. Ritson, *Collection of Ballads concerning Robin Hood.*

Hood, Samuel, Viscount, a British admiral, born 1724, died 1816. He joined the navy as a midshipman in 1740, and attained the rank of post-captain in 1759. Having become rear-admiral, he preserved the Island of St. Christophers from being taken by de Grasse, assisted in the defeat of de Grasse by Rodney in 1782, and was rewarded with the title of Baron Hood of Catherington in the Irish peerage. In 1793 he commanded against the French in the Mediterranean, and captured Toulon and Corsica. In 1796 he was made an English peer, with the title of Viscount Hood.

Hood, Sir Samuel, cousin of the above, born 1762, died 1814, was present at the battle of the Nile, 1798; captured Tobago and the Dutch settlements in Guiana, 1803; and defeated the French squadron off Rochefort in 1806.

Hood, Thomas, an English poet and humorist, of Scottish extraction, born at London 1799, died 1845. During a residence at Dundee, and while only fifteen or sixteen years of age, he contributed articles to a local paper and magazine. In 1821 he became sub-editor of *The London Magazine*, and in 1826 appeared his *Whims and Oddities*, which was followed by *National Tales* and a volume of serious poetry. From 1829 to 1837 he conducted *The Comic Annual.* At the same time his pen was employed on other subjects, and he published *The Epping Hunt*, a comic poem, ridiculing Cockney sportsmen; *Eugene Aram's Dream*, inserted in *The Gem*, of which he was for a short time editor; and *Tylney Hall*, a novel. In 1837, on the termination of *The Comic Annual*, he commenced a monthly periodical entitled *Hood's Own*, which consisted chiefly of selections from the former work. His health now began to fail, and with a view to its recovery he paid a visit to the Continent. While there in 1839 he published his *Up the Rhine*, which, based on the lines of *Humphry Clinker*, was very popular. Shortly after his return he undertook the editorship of *The New Monthly Magazine*, and continued it till 1843. His principal contributions to it he published separately, under the title of *Whimsicalities.* His last periodical, entitled *Hood's Magazine*, was commenced in 1844; but his health shortly afterwards completely broke down, and his death occurred in the following year. It was during his last illness that he contributed to *Punch*, *The Song of a Shirt*, *The Bridge of Sighs*, and *The Lay of a Labourer*. Hood is unrivalled as a punster, and he possesses a singular power of combining the humorous with the pathetic. He had the satisfaction of knowing that the pension of £100 conferred upon him on his last illness by Sir Robert Peel was to be transferred to his wife. *Memorials of Thomas Hood*, by his daughter, were published in 1860.—Cf. Walter Jerrold, *Thomas Hood: his Life and Times.*

Hood, Tom, son of the great humorist, and a miscellaneous writer, born 1835, died 1874. He studied at Oxford, and during his residence there he wrote *Pen and Pencil Pictures.* In 1861 appeared his *Daughters of King Daker, and other Poems.* In 1865 he became editor of *Fun*, which became very popular under his management. His talents, although similar to those of his father, were less brilliant.

Hooded Seal (*Cystophŏra cristāta*), a species of seal, the male of which possesses a movable, inflatable muscular bag, stretching from the muzzle to about 5 inches behind the eyes. The prevailing colour is dark-grey with spots of deeper tint—the head and limbs being uniformly black. Its usual range extends in America southwards to Newfoundland, and in Europe to Southern Norway.

Hoofs, the horny tissues which constitute the external part of the feet of certain animals, mostly herbivorous. They may be regarded as homologues of the toe-nails of other animals. They are composed of epithelial cells, agglutinated and dried, and of intercellular substance and cell contents. Chemically they consist of keratin.

Hooge, a village of Belgium, in the province of West Flanders. Situated on the Ypres-Menin road, it was the head-quarters of Earl French (then Sir John) during the first battle of Ypres. The village was taken by the Germans in May, 1915. The site of Hooge was retaken by British troops in July, 1917, and the region finally cleared in Sept., 1918.

Hooghly River. See *Hugli.*

Hook, Theodore Edward, novelist and journalist, born 1788, died 1841, was the son of James Hook, a musical composer. After leaving Harrow he helped his father with the libretto of a comic opera, *The Soldier's Return*, instead of reading for Oxford. For some years Hook led a life of gaiety in London, and became notorious for practical jokes and similar escapades. In 1812 he was appointed Accountant-General and Treasurer of the Island of Mauritius; but, owing to his gross carelessness, a serious deficiency in the Treasury accounts was discovered, and in 1818 he was sent home under arrest, but no proceedings were taken against him. From 1820 to 1841 he was editor of *John Bull*, and at intervals from 1824 to 1828 he published his *Sayings and Doings*, while in 1836 he became editor of *The New Monthly Magazine.* His other principal works are *Life of Sir David Baird*, and a series of novels, among which may be mentioned: *Love and Pride*, *Jack Brag*, *Gilbert Gurney*, *Gurney Married*, *Precepts and Practice*, and *Fathers and Sons.* Hook was satirized by Thackeray in *Vanity Fair*, and by Disraeli in *Coningsby.*—Cf. R. H. D. Barham, *Life and Remains of Hook.*

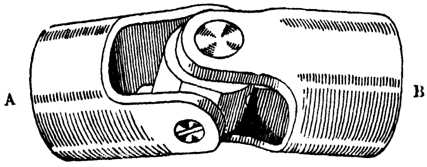
Hooke, Robert, an English mathematician and natural philosopher, born 1635, died 1703. He is chiefly known as the discoverer of *Hooke's Law*, which he stated in the form " Ut tensio sic vis "; the meaning being that in elastic bodies stress is proportional to strain. In 1664 he became Cutlerian professor of mechanics to the Royal Society, and in 1664 professor of geometry at Gresham College. He partially anticipated the Newtonian theory of gravitation and the undulatory theory of light, and invented or materially improved many scientific and mechanical instruments.

Hooker, Sir Joseph Dalton, British scientist, second son of Sir William Jackson Hooker, born at Halesworth, Suffolk, 30th June, 1817, died 10th Dec., 1911. He studied medicine at the University of Glasgow, where he took his degree in 1839. His first botanical work began in his father's herbarium, but in 1839 he accompanied Sir James Ross's Antarctic expedition in the *Erebus*, and published an account of the flora of the sub-Antarctic and south temperate regions. His desire to acquire more knowledge of the flora of Oriental tropics made him lead a botanical expedition to North India in 1848. He was appointed assistant director of Kew Gardens in 1855, and succeeded his father as director in 1858, retaining this post till 1885, when he retired. Hooker was an intimate friend of Darwin, and it was through his and Sir Charles Lyell's influence that Darwin was induced to publish his first statement of the theory of natural selection. Knighted in 1877, Hooker received the Order of Merit in 1907. His works include *Genera Plantarum* and *Flora of the British Isles.*

Hooker, Richard, English ecclesiastical historian, born 1553, died 1600. He went up to Oxford in 1563, and became a Fellow of Christ Church in 1577. In 1579 he was appointed deputy professor of Hebrew; took orders in 1581, and was made preacher at Paul's Cross. About this period he was induced to marry the daughter of Mrs. Churchman, who had charge of the dwelling set apart for the preachers—a marriage which proved the reverse of happy. In 1584 he became rector of Drayton Beauchamp, and in 1585 Master of the Temple. In 1595 he received the living of Bishopsbourne, in Kent, where he ended his days. His *Ecclesiastical Polity*, published at various dates, and written in defence of the Church of England, is no less remarkable for learning and extent of research than for the richness and purity of its style, which entitles its author to be regarded as one of the classics of the Elizabethan age.—BIBLIOGRAPHY: Izaak Walton, *Life of Richard Hooker*; Vernon Staley, *Life of Richard Hooker.*

Hooker, Sir William Jackson, a celebrated botanist, father of Sir Joseph Hooker, born 1785, died 1865. From 1821 to 1841 he was professor of botany at Glasgow University; he was knighted in 1836; and became director of Kew Gardens in 1841. He wrote, among other works, *The British Jungermanniæ*, *Icones Plantarum*, and *A Century of Orchidaceous Plants.*

Hooke's Joint, or Universal Joint, a device for transmitting a continuous rotational motion from a shaft A to another B which is not parallel to A (see fig.). The angular velocity ratio is not constant. It varies during each revolution from a maximum value, $\sec\theta$, to a minimum value $\cos\theta$, where θ is the acute angle of inclination of the shafts. There are two maximum values and two minimum values per revolution. If a constant angular-velocity ratio is required, a double Hooke's joint can be used. This consists of two Hooke's joints coupled by an intermediate idle rod. It is essential that the lines through the joint pins on the intermediate rod, at each end, shall lie in the same plane. If this is not the case, the irregularity in the angular-velocity ratio is worse with the double joint than with the single one. A kind of hydraulic Hooke's joint is to be found in the Williams-Janney gear.



Hooke's Universal Joint

Hooligan, a term first applied towards the end of the nineteenth century to a gang of young ruffians under the leadership of one Hoolly or Hooligan, whose terrorizing exploits extended over the Southwark district, London. The gang became known as the Hoolly gang, or the Hooligans. Spreading over Europe, the term is now applied to all gangs of ruffians and street rowdies. The Parisian *apache* and the Australian *larrikin* are counterparts of the hooligan, although the latter is less associated with crime than the two former.

Hoop-ash (*Celtis crassifolia*), an American tree of the ord. Urticaceæ, found in the forests of Ohio and in the Western States. It is a fine tree, attains a height of 80 feet, and is employed for making charcoal. Its fruit is round, and in size nearly equal to a pea. See *Hackberry* and *Nettletree.*

Hooper, John, an English reformer, born 1495, burnt 1555. Having studied at Oxford, he joined the Cistercian order; but by the year 1539 he had adopted the reformed opinions, and withdrew to the Continent on the imposition of new articles of faith by Henry VIII, and lived at Zürich. In 1547 he returned to England, and took an active share in the Edwardian Reformation. In 1550 he was nominated Bishop of Gloucester, but declined consecration until certain vestments and ceremonies were dispensed with in his case. On the accession of Queen Mary, in 1553, Hooper was deprived and imprisoned, and in 1555 burnt at Gloucester, near his own cathedral. His works consist chiefly of *A Godly Confession and Protestation of the Christian Faith*, *Lectures on the Creed*, *Sermons on the Book of Jonah*, *Annotations on the Thirteenth Chapter of the Epistle to the Romans*, and expositions of several psalms.

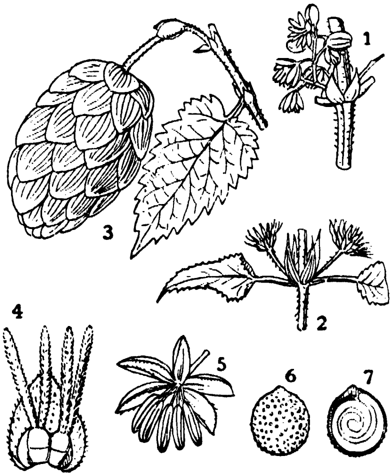
Hoopoes (*Upŭpa epops*)

Hoopoe (Upŭpa), a bird forming the type of a family (Upupidæ) related to that including the hornbills. The European hoopoe (*U. epops*) is about 12 inches long; it has a fine crest of pale cinnamon-red feathers, tipped with black; upper surface on the whole ashy-brown; wings black, the coverts having white bars; throat and breast pale fawn; abdomen white, with black streaks and dashes. It has a very wide range through Europe, North Africa, and Asia to Japan. It is a ground-feeder, preying chiefly on insects, and seems to delight in filth; it nests in cavities of trees or walls, and its eggs vary from four to seven. The hoopoe utters a loud double or treble *hoop*, whence its name. A well-known Arab legend describes the endowment of this bird by Allah with a golden crest, afterwards converted into feathers in answer to the petition of the persecuted wearer.

Hoorn (hōrn), a seaport of Holland, on a small bay of the Zuider Zee, 20 miles N.N.E. of Amsterdam. The trade is extensive, more especially in cheese, and there is some shipbuilding and other industries. Pop. 11,244.

Hoover, Herbert Clark, American mining engineer and Food Controller, born in 1874 at West Branch, Iowa, where his father, a Quaker, worked a farm. Educated at the Leland Stamford University, he went to California, became a mining engineer, and went out to Western Australia and China. During the siege by the Boxers in 1900 he was in Tientsin, where he defended not only his European fellow-workers, but also the Chinamen in his service. Hoover became famous during the European War, first as chairman of the American Relief Committee in London, and Commissioner for Relief in Belgium, and afterwards, when America entered the war, as Food Controller. Thanks to his energy and wise administration, his country was able to provide a surplus for feeding Europe. Director of European Relief, he became Secretary of Commerce in 1920 under President Harding, and was appointed to superintend the relief to be sent to famine-stricken Russia. He wrote *Principles of Mining*.

Hop (*Humŭlus Lupŭlus*), a plant of the nat. ord. Moraceæ, a native of Europe, and perhaps of the United States, where it occurs wild. The root is perennial, giving out several herbaceous, rough, twining stems, with large lobed leaves;



Hop (*Humŭlus Lupŭlus*)

1, Male flower. 2, Female flower. 3, Strobile. 4, Female flower (enlarged). 5, Male flower (enlarged). 6, Fruit (enlarged). 7, Section of fruit (enlarged).

the fertile flowers are green; the fruit is a catkin, and the plant is cultivated for the sake of the catkins, which are employed to communicate to beer its aromatic bitter flavour. The young shoots are sometimes boiled and eaten like asparagus; the fibres of the old stems make good cords. The cultivation of the hop is more carefully attended to in England than in any other country, Kent being the chief county in which it is grown; but the plant is also extensively reared in other parts of Europe, as also in North America, Australia, New Zealand, &c. The use of the hop catkins depends upon a peculiar bitter substance which they contain, called *lupulin*, which is a yellow powder, containing a bitter principle and a volatile oil. The lupulin constitutes from 10 to 12 per cent by weight of the catkin, and the bitter principle forms from 8 to 12 per cent of the lupulin. Having tonic, stomachic, and narcotic properties, hops are often used medicinally. Pillows stuffed with hops are used to induce sleep.

Hop-clover (*Trifolium procumbens*), a plant of the ord. Leguminosæ, distinguished from other species of clover by its bunch of yellow flowers, which wither to the bright brown of a strobile of hops.

Hope, Anthony, pseudonym of Sir Anthony Hope Hawkins, British novelist, born in London 9th Feb., 1863. Educated at Marlborough and at Balliol College, Oxford, where he graduated with high classical honours, he studied law and was called to the Bar in 1887, but devoted his activities to literature. Some of his first books, *A Man of Mark* and *Sport Royal*, attracted attention, but he became generally known only after the publication of his *Dolly Dialogues* (1894), a delightful and brilliant work which first appeared in *The Westminster Gazette. The Prisoner of Zenda*, his first romantic novel (1894), met with an immediate success. Other works are: *The Chronicles of Count Antonio* (1895), *Rupert of Hentzau* (1898), *Simon Dale* (1898), *Quisanté* (1900), *Mrs. Maxon Protests* (1911), *A Young Man's Year* (1915), *Beaumaroy Home from the Wars* (1919). He was knighted in 1918. Hope is a master of dialogue, and his works are distinguished both by command of plot and a sense of humour.

Hope, Thomas, an English writer and art patron, born 1770, died 1831. He inherited great wealth, and devoted much of his time while young to extensive travels in various parts of Europe, Asia, and Africa. His principal works are: *Household Furniture and Internal Decorations*; *The Costume of the Ancients*; *Anastasius, or Memoirs of a Modern Greek*, a novel displaying remarkable descriptive powers and a minute accuracy in the accounts of Eastern life; and *An Historical Essay on Architecture.*

Hop-flea (*Haltica concinna*), a beetle which belongs to the same genus as the turnip-fly, and which devastates hop plantations. These insects eat up the young shoots, and even after the hop stems have grown 8 or 9 inches long they will devour every leaf and head.

Hop-fly (*Phorodon humŭli*), a species of plant-louse very destructive to the hop. The winged female is green, with a black head and bands and spots of black on the body; the legs and wings are long. A few winged females make their first appearance about the middle of May, and wingless myriads by the middle of June. The insects suck the under side of the upper leaflets, and there deposit their young on the most succulent part of the plant. Myriads perish by means of lady-birds and other insects, as well as by their extreme susceptibility to atmospheric changes. Winged males and females are produced in autumn, when the fertilized eggs are laid on the branches of damson trees. In spring these hatch out into winged females that migrate to the hop.

Hopkins, Edward John, British composer and organist, born at Westminster 30th June, 1818, died 9th Feb., 1901. He was a chorister in the Chapel Royal from 1826 to 1834, then organist at Mitcham Church, Surrey, and in 1843 was appointed organist at the Temple Church, London, retaining this post till 1898, when he retired. Hopkins raised the musical service to a high degree of perfection, and published *The Organ: its History and Construction.* He also issued a *Book of Responses*, and *The Temple Psalter.*

Hoppner, John, English painter, born in 1758 in London, of German parents, died 1810. He studied at the Royal Academy schools, and first exhibited at the Academy in 1782. Under the patronage of the Prince of Wales, he soon acquired a lucrative practice as a portrait painter. He was elected A.R.A. in 1792 and R.A. in 1795. The chief rival of Lawrence, he painted most of the prominent men and women of the day, especially those in the circle of the Prince of Wales. Among his more important works are portraits of the Prince of Wales and other members of the royal family (in the Royal Collection), and portraits of Pitt, Canning, and Grenville. He is adequately represented in the Tate Gallery and the National Portrait Gallery. Despite his vogue in the sale-room, Hoppner is little more than a facile, fashionable portrait painter, whose style imitates that of Reynolds, with occasional borrowings from Gainsborough.

Hor, or **Jebel Haroun,** a mountain of Arabia Petræa, south-east of Palestine, forming part of the range of Seir or Edom, and the scene of the death of Aaron; height, 4800 feet.

Horace (Quintus Horatius Flaccus), Roman poet, was born on 8th Dec., 65 B.C., and died on 17th Nov., 8 B.C. His father was a freedman, who earned a fairly comfortable livelihood as a collector of taxes; of his mother we know nothing, which makes it probable that she died during the poet's childhood or infancy. Horace always speaks of his father in the most glowing terms of affection and reverence, and attributes much of his success in after life to his father's wise guidance and good example. His father was a strong believer in a liberal education, and did not consider the local country school good enough for his son; he took the boy to the best school in Rome, and afterwards sent him, when aged about seventeen, to the University of Athens. Horace was probably at Athens when Julius Cæsar was murdered (15th March, 44 B.C.), and soon after, in an outburst of Republican zeal, joined the army of Brutus. Owing to a shortage of officers, he was soon given a senior commission, being appointed *tribunus militum*, a rank more or less equivalent to our lieutenant-colonel. He was present at the battle of Philippi, and took part in the general flight of the Republican forces. He was not designed by nature to be a soldier, but there is no reason to suppose him more inefficient than the majority of amateur soldiers. Several of Horace's own allusions to his flight are jocular in tone, which is not the tone assumed by a coward; and he probably would not have emphasized the fact that he dropped his shield had not that same accident happened to Alcæus, whose metre and style Horace imitated. He returned to Italy to find his property confiscated and his father dead. He managed to scrape together enough money to purchase for himself an underclerkship in the Civil Service, and by strict economy he was able to live on his salary. He eked out his livelihood by means of writing verses, and he made the acquaintance of other poets and literary men, among whom were Virgil and Varius. In 38 B.C. they introduced him to Mæcenas, the minister of Augustus, who became his life-long friend and patron. Mæcenas presented Horace with a Sabine farm, which made the poet able to leave his Civil Service appointment. From this time Horace divided his time between Rome and his Sabine farm; it is the delight in both city and country life that gives Horace's poetry some of its unique qualities. Mæcenas introduced Horace to Augustus, who offered him a post as private secretary, which the poet, wise in his generation, declined. Meanwhile he was slowly producing poems of various kinds. The first book of his *Satires*, ten in number, appeared in 35 B.C. In some of these Horace shows himself somewhat immature; he imitated freely the early satirist Lucilius, whom he abused equally freely. There is rather an unpleasant undertone of vulgarity and bitterness in the earlier book of *Satires*. A collection of poems, in iambic and composite metres, known to us as the *Epodes*, was published about 30 B.C. These poems, which follow Archilochus, the Greek satirist, as a model, are not pleasing; many of them are scurrilous personal lampoons. They may perhaps not be meant very seriously; it has been suggested that there is a tone of parody about them.

Horace developed late, and it was not until the publication of the second book of his *Satires* (29 B.C.) that he attained maturity. The advance on the first book is most striking; Horace shows himself as a polished man of the world, a master of quiet humour, and a great literary stylist. His mastery over metre is no less remarkable; he has as perfect command over the satirical hexameter as Virgil has over the stately heroic hexameter. Horace possessed to an almost unequalled degree the faculty of being able to write about himself without being tedious. Most of these satires are about himself, yet none are egotistic. In 19 B.C. Horace produced what may be considered his greatest work, the first three books of his *Odes*. These poems are perhaps as well known as any poems in the world; almost every line of them has become proverbial. It is easy to criticize them; it is plain that Horace has not got the fire of Shelley or Catullus, and that there was no 'unpremeditated art' about him. His love poems do not ring true. Some of them may be simply translations from the Greek. Yet the value of the *Odes* is great. For choice language and for clothing commonplace thought in an unforgettable form they are unequalled. Horace is the poet of those who do not as a rule love poetry; he is a matchless master of language; he is a skilful adapter of Greek metres. In some of his Roman odes he is even more than this; his love for Rome was much deeper than his love for Chloe, and there is no loftier patriotic poetry in the world than the opening odes of the third book. Soon after the publication of the *Odes* Horace published the first book of his *Epistles*, where we see the wise author of the *Satires* mellowed by the passage of time. In the *Epistles* Horace reveals himself most clearly, and brings this branch of his art to perfection. He had by this time attained a position at court not unlike that of Poet Laureate, and in 17 B.C. he was commissioned to write an ode to be sung at the secular games (the *Carmen Seculare*). It is a dignified composition, but does not rise much above the level of official verse. The fourth book of the *Odes*, published probably in 13 B.C., may be regarded as a semi-official publication, some of the poems celebrating the victories gained by Drusus and Tiberius. The second book of *Epistles*, consisting of two only, deals mainly with literary criticism, as does the *Epistula ad Pisones*, usually known as the *Ars Poetica.* The *Ars Poetica* gives rules for writing tragedies, a form of composition which Horace never attempted, and which he discusses with rather less than his ordinary good sense. This poem was treated by later critics almost as if it had been divinely inspired; Boileau, for example, allowed no appeal from the authority of Horace. Horace died somewhat suddenly in his fifty-seventh year.

There is no writer, ancient or modern, whom we feel we know so intimately as we do Horace. He tells us all about himself; even his personal appearance is familiar to us. He was small, with dark eyes and dark hair, which went grey in front; he was inclined to be stout, and had weak eyesight. Horace is one of the best loved of all authors. In the days when there were gentlemen, it was part of a gentleman's education to know his Horace by heart. When Latin was understood in the House of Commons, debates were frequently enlivened by Horatian quotations. His popularity is partly due to his exquisite choice of language, that which Petronius called " Horati curiosa felicitas ", and which makes him the most quotable of authors. It is, however, due more to those qualities which make him the most companionable of poets—it is due to his *Satires* and *Epistles* even more than to his *Odes.* We cannot always be on the heights with Æschylus and Dante and Shakespeare. Horace is the poet of the workaday world, the greatest of all the second class of poets. No other poet who is so essentially national and ' of an age ' has managed also to become ' for all time '.

BIBLIOGRAPHY: (Editions): Bentley's edition of 1711, while admitting conjectural emendations too freely, marked an epoch in the study of Horace. There is a good edition by J. C. Orelli, and another by E. C. Wickham. There are useful editions for ordinary students by J. Gow and by T. E. Page (*Odes*), A. Palmer (*Satires*), and A. S. Wilkins (*Epistles*). (Critical dissertations): W. Y. Sellar, *Horace and the Elegiac Poets*; H. E. G. Patin, *Études sur la poésie latine.* (Translations): Of making many translations of Horace there is no end, the reason being that he is untranslatable. The best complete translation is that by J. Conington; C. S. Calverley has translated some few odes in his own inimitable way. The translation by Sir Theodore Martin has not much to recommend it; neither has that which used to be considered the standard one, by Philip Francis (published 1742-6).

Horæ, in classical mythology, the goddesses of the seasons and the order of nature. At Athens they were originally two: Thallo and Carpo. Elsewhere they were at first three: Thallo, Carpo, and Auxo, and afterwards increased to four. They are represented as maidens carrying the different products of the seasons.

Horæ Canonicæ, or simply **Horæ**, in the Roman Catholic Church the canonical or appointed hours at which certain hymns and devotions, themselves termed *Horæ* or *Hours*, are performed in monasteries. See *Canonical Hours.*

Horapollo, the alleged author of a work on Egyptian hieroglyphics supposed to have been translated from the Egyptian into Greek. By many authorities the book is considered to have been written about the fifth century and translated as late as the fifteenth.

Horatii, three Roman brothers, who, according to tradition, in the reign of Tullus Hostilius engaged three Alban brothers (the Curiatii), in order to decide the supremacy between Rome and Alba. Victory went to Rome, and the sole surviving Horatius was triumphantly conducted back to the city. But his sister had been betrothed to one of the Curiatii, and her demonstrative grief so enraged Horatius that he stabbed her. For this he was condemned to death, but his father and the people begged him off.

Horatius Cocles, a hero of ancient Rome. The Tarquins having, after their banishment, sought refuge with the Etrurian king Porsenna, the latter advanced against Rome (507 B.C.) to restore them. According to tradition, Horatius Cocles, along with two companions, held the Sublician bridge against the enemy, while the Romans broke it down behind them. When this was nearly finished, he sent back his two companions, and as the bridge fell he plunged into the Tiber with his armour and safely reached the opposite bank.—Cf. Macaulay, *Lays of Ancient Rome.*

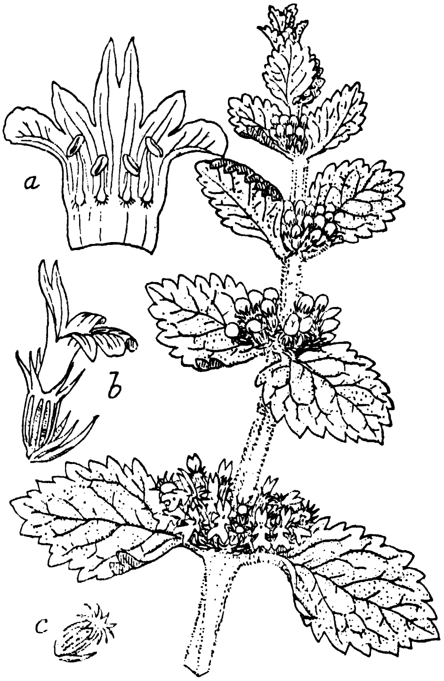
Horbury, a town (urban district) of England, W. Riding of Yorkshire, 3 miles south-west of Wakefield, with manufactures of woollen goods. Pop. 7509.

Hörde (heur'dė), a town of Germany, in Westphalia, on the Emscher, a centre of the iron manufacture, and having large coal-mines. Pop. 29,000.

Horeb (Ar. *Jebel Mûsa*, Mountain of Moses), a mountain belonging to the same ridge as Mount Sinai, where is still pointed out the rock from which water issued at the blow of Moses.

Horehound (*Marrubium vulgāre*), a labiate plant, with whitish, downy leaves and stem; flowers small, nearly white, in crowded whorls, possessing an aromatic smell and bitter flavour. It is a popular remedy for coughs and colds, usually as an infusion. It is a native of Britain and Europe generally. Black horehound (*Ballōta nigra*), also a labiate plant, is a malodorous and unattractive weed.

Hori'zon, in ordinary speech the line where earth and sky seem to meet, or the circle which bounds that part of the earth's surface visible to a spectator from a given point. This is termed the *sensible*, *visible*, or *apparent horizon*, as distinguished from the *rational* or *true horizon*, an imaginary great circle, parallel to the sensible horizon, whose plane passes through the earth's centre, whose poles are the zenith and the nadir, and which divides the celestial sphere into upper and lower hemispheres. In observations with the sextant on land, or at sea when the horizon is observed, a small basin containing mercury may serve as an *artificial horizon*. The observer then measures the angle between the sun or star and the image of the sun or star in the basin of mercury, and it is easily seen that half this angle is the altitude of the object. In geology, the term is applied to any well-marked formation which suffices as a starting-point from which to study the rest.



White Horehound (*Marrubium vulgāre*)

a, Corolla opened. *b*, Flower. *c*, Calyx showing hooked teeth.

Horn, Hoorne, or **Hornes,** Philip, Count van, a Flemish soldier and statesman, born 1518, beheaded in June, 1568. He was the son of Joseph de Montmorency-Nivelle, and of Anne of Egmont, and stepson of John, Count van Horn, who constituted him and his brother his heirs on the condition of assuming his name. Philip gradually rose to be Governor of Gueldres and Zutphen, Admiral of the Fleet, and Councillor of State. He fought at St. Quentin in 1557, and Gravelines in 1558, and in 1559 accompanied Philip to Spain. On his return he joined the Prince of Orange and Egmont in resistance to Philip. On the arrival of Alva at Brussels he was arrested, in Sept., 1567, on a charge of high treason, and he and Egmont were beheaded.

Horn, a general term applied to all hard and pointed appendages of the head, as in deer, cattle, &c., but as a term denoting a particular kind of substance nothing should be called horn which is not derived from the epidermis or outer layer of the integument, whether on the trunk, hoofs, or head. Horn is a tough, flexible, semi-transparent substance, most liberally developed in the horns of bovine animals, but also found in connection with the 'shell' of the tortoise, the nails, claws, and hoofs of animals, the beak of bird and turtle, &c. Horn is softened very completely by heat, so as to become readily flexible, and to adhere to other pieces similarly softened. True horn consists principally of an albuminoid substance, *keratin*, with a little gelatine and phosphate of lime. In some species of animals the males only have horns, as for instance the stag. In cattle both male and female have horns, though there are also hornless or polled cattle. Horns differ widely in the case of different animals. Thus the antlers of deer consist of bone, and are deciduous; those of the giraffe are independent bones, with a covering of hairy skin; those of oxen, sheep, and antelopes consist of a bony core covered by a horny sheath. The horns of the rhinoceros alone consist exclusively of horny matter. The horns of oxen, sheep, goats, and antelopes are never shed, except in the case of the prong-horned antelope. The number never normally exceeds four, and in the case of deer the antlers are usually branched.

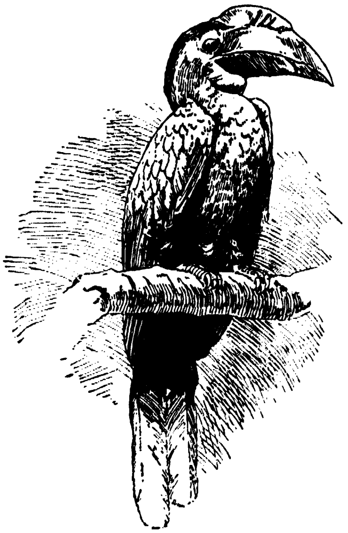
The various kinds of horns are employed for many purposes. The ones mostly used in the arts are those of the ox, buffalo, sheep, and goat. Deer antlers are almost invariably turned into handles for knives, sticks, and umbrellas. Horns which furnish true horn can be softened by heat (usually in boiling water), cut into sheets of various thickness, which sheets may be soldered or welded together at the edges so as to form plates of large dimensions, and polished and dyed so as to imitate the much more expensive tortoise-shell. Clippings of horn may be welded together in the same manner, and made into snuff-boxes, powder-horns, handles for umbrellas, knives, forks, &c. As horn has the valuable property of taking on and retaining a sharp impression from a die, many highly ornamental articles may be turned out. Combs for the hair are made from the flattened sheets, and out of the solid parts of buffalo horns beautiful carvings are made.

Horn, French (Fr. *cor de chasse*, Ger. *waldhorn*), a musical instrument, originally formed, as the name denotes, from the horn of an animal. The name includes a large family of wind-instruments, many of which have fallen into disuse. The French horn, or simply *the horn*, consists of a metallic tube of about 10 feet in length, very narrow at top, bent into rings, and gradually widening towards the end whence the sound issues, called the *bell*. It is blown through a cup-shaped mouthpiece of brass or silver, and the sounds are regulated by the player's lips, the pressure of his breath, and by the insertion of the hand in the bell of the instrument. As a simple tube, unprovided with holes, the horn yields only the generating note, and of course would be confined to one key; but by means of *crooks* the tube can be lengthened, and transposed into any key. By inserting the hand into the bell, which flattens a note, the sounds which are wanting are produced. The compass of the instrument is three octaves. Music for the horn is always written on the key of C, an octave higher than it is played, with the key of the composition marked at the beginning of each movement; thus ' corni (or horns) in D ' directs the performer which crook he must use to play the notes in the key indicated. The bugle, cornet-a-piston, and sax-horn are allied instruments.—Cf. J. Blaikley, *The French Horn*.

Hornbeam (*Carpīnus Betŭlus*, nat. ord. Cupuliferæ), a small bushy tree common in Britain, and often used in hedges, as it stands cutting and in age becomes very stiff. The wood is white, tough, and hard, and is used in turnery, for cogs of wheels, &c. The inner bark yields a yellow dye. The American hornbeam (*Carpīnus americāna*) is a small tree sparingly diffused over the whole of the United States. The wood is fine-grained, tenacious, and very compact.

Hornbills, a remarkable family of birds (Bucerotidæ), mostly confined to Africa and Southern Asia, but also ranging into the Australian region, though not into Australia; akin to the kingfishers and the hoopoes, remarkable for the very large size of the bill, and for an extraordinary horny protuberance by which it is surmounted, nearly as large as the bill itself, and of cellular structure within. The rhinoceros hornbill (*Bucĕros rhinoceros*), native to the Malay Peninsula and Indo-Malay islands, is almost the size of a turkey, of a black colour, except on the lower part of the belly and tip of the tail, which are white. It has a sharp-pointed, slightly-curved bill, about 10 inches long, and furnished at the base of the upper mandible with an immense appendage in the form of an inverted horn. The skeleton though bulky is very light, being permeated with air to an unusual degree. During incubation the female is plastered up in the hollow of a tree and fed by the male through a small aperture left for the purpose. The hornbills are of arboreal habits, and feed on fruits; but in captivity they take small reptiles, and the Abyssinian species even attacks snakes.

Hornblende (-blend), the typical member of the *amphiboles*, one of the most abundant and widely diffused groups of minerals, occurring principally in igneous rocks. The amphiboles are also important constituents of several species of metamorphic rocks. In colour hornblende exhibits various shades of green, often inclining to brown and black; it is nearly transparent in some varieties, but is commonly opaque; hardness a little less than that of felspar; specific gravity, 3·00. It is an aluminous magnesium iron silicate, with some calcium, and often arises from slow processes of change in augite, the corresponding pyroxene. The prism angles in hornblende, as in the amphiboles generally, are 124° and 56°, as against 87° and 93° in the pyroxenes (see *Augite*). Hornblende containing sodium connects this mineral with the blue species *glaucophane* and *riebeckite*. Glaucophane is common in schists in the Western Alps of Italy.



Crested Hornbill

Hornbook, in former times the first book of children, or that in which they learned their letters: so called from the transparent horn covering placed over the single page of which it usually consisted, the whole being fixed to a wooden frame with a handle. It generally contained the alphabet in Roman and small letters.

several rows of monosyllables, and the Lord's Prayer. The alphabet was usually prefaced with a cross, or was printed in the form of a cross; hence the term Christ-cross row, corrupted into *criss-cross* row, applied to the alphabet, and by extension to the hornbook. The first hornbook was made about 1450. It is referred to in Shakespeare's *Love's Labour's Lost,* v, 1.—Cf. A. W. Tuer, *History of the Hornbook.*

Horncastle, a town of England, county of Lincoln, 21 miles east of the city of Lincoln. There is a considerable trade in corn and wool, and one of the largest horse-fairs in the United Kingdom is held annually in August. Pop. 3461. Horncastle is one of the parliamentary divisions of Parts of Lindsey.

Horne, Henry Sinclair Horne, Baron, British soldier, born at Caithness, 19th Feb., 1861. Educated at Harrow and the Royal Military Academy, Woolwich, he obtained a commission in the Royal Artillery in 1880. He served in the South African War (1899–1902), and became a lieutenant-colonel in 1905. When the European War broke out, he went to the front as commander of an artillery brigade, was in Gallipoli and Egypt, where he defended the Suez Canal, and in 1916 commanded the 1st Army. Knighted in 1916, he was raised to the peerage in 1919 as Baron Horne of Stirkoke, county of Caithness, and received a grant of £30,000.

Horne, Richard Hengist, poet, dramatist, and miscellaneous writer, born 1803, died 1884. He was educated for the army at Sandhurst, entered the Mexican navy, and served during the war between Mexico and Spain. In 1828 he began his literary career, and produced several tragicomedies of an ironical and satirical kind, and a large quantity of miscellaneous work. In 1843 he made his historic appeal to public judgment by publishing his epic *Orion* at one farthing. In 1844 *A New Spirit of the Age,* a critical work in which he was assisted by Miss Barrett (Mrs. Browning) and Robert Bell, appeared. In 1852 he took to gold-digging in Australia, still keeping in touch with his literary work. Of his many writings, the best known are: *Orion, Cosmo de Medici, The Death of Marlowe,* and *Prometheus.*

Horne, Rt. Hon. Sir Robert Stevenson, British lawyer and politician, born 28th Feb., 1871, the son of a minister of the Church of Scotland. Educated at George Watson's College, Edinburgh, and at Glasgow University, he was for some time lecturer in philosophy at the University College of North Wales, and in 1896 was called to the Scottish Bar. Assistant Inspector-General of Transportation in 1917, he was transferred to the Admiralty, where he became Director of the Labour Department and subsequently Third Civil Lord. He entered Parliament in 1919 as member for the Hillhead division of Glasgow, was Minister of Labour, 1919 to May, 1920, and President of the Board of Trade, May, 1920 to April, 1921, when he became Chancellor of the Exchequer.

Horned-owl, a familiar name applied to several species of owls having two tufts of feathers on the head supposed to resemble horns. See *Owl.*

Horned-screamer (*Palamedea cornūta*), a South American bird ranging from Guiana to Peru, and the type of a special family (Palamedeidæ) related to ducks and geese. A long, slender, movable horn of yellowish-white colour projects from its forehead. Its voice is loud and shrill, and is uttered suddenly and with such vehemence as to have a very startling effect.

Horned-toad, a name given to a genus of lizards (Phrynosōma), of toad-like appearance, found in North America west of the Mississippi and in Central America. There are about a dozen different species, all more or less covered with spine-like scales.

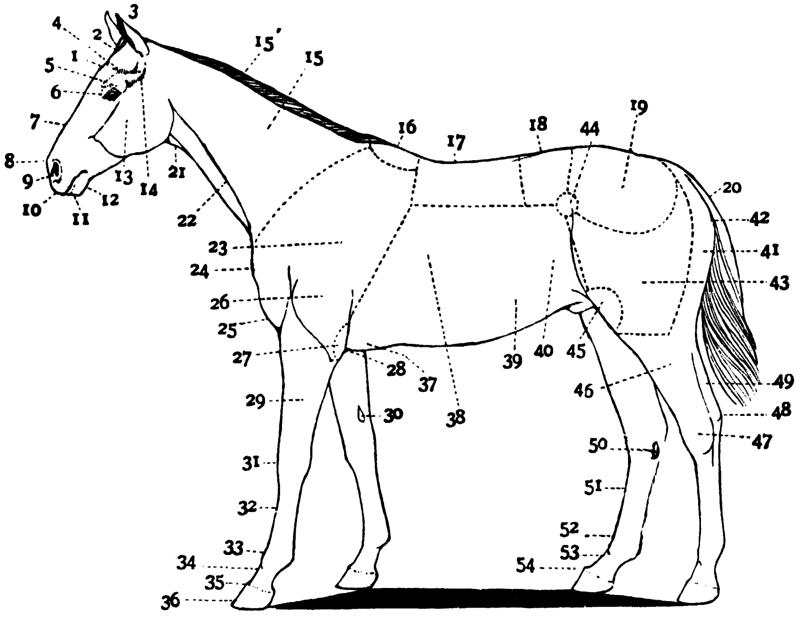
Hornet, an insect of the genus Vespa (*V. crabro*), much larger and stronger than the ordinary wasp. It is very voracious, feeding on fruit and honey, and preying on other insects. They form their nest of a kind of paper-work in hollow trees and walls, and are able with their sting to inflict a painful wound, usually accompanied by considerable swelling.

Horning, in Scots law, a writing commanding a debtor in the sovereign's name to pay within a certain time under pain of being 'put to the horn' and declared a rebel with three blasts of the horn.

Hornsey, a municipal and parliamentary borough of North London, in the county of Middlesex. It returns one member to the House of Commons. Pop. 87,691.

Horn Silver Ores, so called because they have a resinous horny appearance, a group of sectile ores ranging from *chlorargyrite,* silver chloride, which is colourless, through species containing bromine and iodine to *iodyrite,* silver iodide, which is yellowish to brown. *Cerargyrite* is a mineral name used to cover the whole group.

Ho′roscope (Lat. *horoscopium,* Gr. *horoskopion,* from *hora,* hour, and *skopein,* to view), in astrology, a scheme or figure of the twelve houses, or twelve signs of the zodiac, in which is marked the disposition of the heavens at a given time and place, and by which astrologers formerly told the fortunes of persons, according to the position of the stars at the time of their birth. To each of the houses was assigned a particular virtue or influence. The ascendant was that part of the heavens which was rising in the east at the moment; this was the first and most important house, or house of life, and contained the five degrees above the horizon and the twenty-five beneath it. Other houses were those of riches, marriage, death, &c. See *Astrology*.



Horse

1, Forehead. 2, Forelock. 3, Ear. 4, Supra-orbit. 5, Eyebrow. 6, Eye. 7, Nose. 8, Nasal peak. 9, Nostril. 10, Upper lip. 11, Lower lip. 12, Chin. 13, Cheek. 14, Temple. 15, Neck. 15', Crest. 16, Withers. 17, Back. 18, Loins. 19, Croup. 20, Tail. 21, Throat. 22, Cervical groove. 23, Shoulder. 24, Shoulder point. 25, Breast. 26, Upper arm. 27, Elbow. 28, Point of elbow. 29, Forearm. 30, Chestnut. 31, Knee. 32, Canon. 33, Fetlock-joint. 34, Pastern. 35, Coronet. 36, Foot. 37, Brisket. 38, Chest. 39, Abdomen. 40, Flank. 41, Buttock. 42, Point of Buttock. 43, Thigh. 44, Haunch. 45, Stifle. 46, Leg or gaskin. 47, Hock. 48, Point of Hock. 49, Tendo Achilles or hamstring. 50, Chestnut. 51. Canon. 52, Fetlock-joint. 53, Pastern. 54, Coronet.

Horse (*Equus caballus*), a well-known mammal belonging to the family Equidæ, ord. Ungulata (hoofed animals), and subdivision Perissodactyla (odd-toed); characterized by an undivided hoof formed by the third toe and its enlarged horny nail, a simple stomach, a mane on the neck, a broad flat tail, a hard bare patch (chestnut) on the inner side of each limb, and by six deeply-pitted incisor teeth in each jaw, seven grinding teeth (the first much reduced and often absent) on either side of both jaws, and by two small canine teeth in the upper jaw of the male, rarely in the female. The family includes also the asses and zebras, and ancestral types appear to have been at one time common in both the Old World and the American continent. No horses existed in America when it was discovered by Columbus, the ones now found in a wild state there being descendants of those introduced by the Spaniards. But a number of fossil species have been described from America—one of them standing only two and a half feet in height. The stages in the evolution of the horse are illustrated by a series of extinct types. The earliest of these were small swamp-dwellers with simple teeth and five-toed plantigrade feet. Then came an animal only about the size of a fox, and having four separate digits or toes on the fore-foot and three on the hind. Subsequent forms show how the third toe developed at the expense of the others till eventually a form identical with the common horse appeared. There was at the same time increase in size, the body was lifted more and more off the ground, and the teeth became more complex. All these changes were adaptations to life on the grassy plains that gradually replaced primeval swamps. It is doubtful whether the horse is now anywhere to be found in its native state, the wild horses of the steppes of Tartary and other regions of the Old World being possibly descendants of animals escaped from domestication. Probably the only really wild horse now existing is a small form (*Equus przewalskii*) indigenous to Central Asia. The horse was probably first domesticated in Asia, and it varies much in form, size, and character with the climate and nature of the district it inhabits. Arabia produces perhaps the most beautiful breed, which is also swift, courageous, endurant, and persevering. As bred in Britain the horse has attained high perfection. Two breeds—namely, the large, powerful, black breed of Flanders, and the Arabian—have contributed more than all others to develop the present British varieties from the original, comparatively light-limbed, wiry race found by Cæsar. The former laid the foundation of size, strength, and vigour for draught-horses and for those anciently used in war, while the latter conferred speed and endurance. The ladies' palfrey is largely derived from the Spanish genet, a small, beautiful, fleet variety of the Moorish barb. The hunter, characterized by speed, strength, and endurance, represents the old English, Flemish, and Arabian breeds. The race-horse has less of Flemish and more of Arabian blood. Other leading varieties are the Shires, Clydesdales, and Suffolk Punches, chiefly of Flanders blood, and the best for draught and agriculture; and several varieties of ponies, as Galloway, New Forest, Shetland, &c. Carriage, riding, and other horses combine the above breeds in varying degrees, as speed, strength, size, &c., are required. Horses are said to have ' blood " or ' breeding ' in proportion as they have a greater or less strain of Arab blood. At the age of two years the horse is in a condition to propagate. The mare carries her young eleven months and some days, continues to breed till the age of sixteen or eighteen years, and lives on an average between twenty and thirty years. The various species of the horse family have been artificially crossed by man, and are found to be fertile with each other; the offspring, however, are generally sterile. The horse is, strictly speaking, an herbivorous animal, and is more scrupulous in the choice of his food than most other domestic quadrupeds. The staple diet on which horses are kept consists of oats and hay, with beans added for animals subjected to heavy work. As a substitute for, or an addition to the regular food, bran, linseed, and carrots are used. The age of a horse can be told by the marks on its teeth, which change a little yearly until the animal is about nine years old, after which period it is difficult to determine the age by mark. In some countries the flesh of the horse is used as food; the hide is made into leather; and the hair of the mane and tail is used for making haircloth, for upholsterers' stuffing, &c.—BIBLIOGRAPHY: Sir W. H. Flower, *The Horse: a Study in Natural History*; J. Wortley Axe, *The Horse: its Treatment in Health and Disease*; R. F. Meysey-Thompson, *The Horse: its Origin and Development combined with Stable Practice*; C. Richardson, *The New Book of the Horse*.

Horse, Master of the, one of the great officers of the British court. He has the management of all the royal stables and bred horses, with authority over all the equerries and pages, coachmen, footmen, grooms, &c. In state cavalcades he rides next behind the sovereign.

Horse-artillery is designed to work with cavalry and support it in the fight. Though not quite as mobile as cavalry themselves, horse-artillery is the most mobile of all artillery. It possesses marked advantages in this respect over field-artillery, and can cover long distances in a minimum of time, and travel over ground which would prove impassable to heavier guns. Strict march discipline and a high degree of horsemastership are necessary to enable horse-artillery to keep pace with cavalry.

Horse-artillery is employed to supplement the fire-power of cavalry, whether that arm is acting mounted or dismounted. It is equally capable of supporting infantry or other arms.

In the British service the officers are specially selected in each rank from the field-artillery, returning again to the latter on promotion. The men are taken from recruits especially selected for smartness and intelligence.

Horse-artillery is at present horse-drawn (in the British service each gun and wagon by teams of six horses), though these may possibly be to some extent replaced in the future by tanks or some form of light mechanical traction.

The gun travels and shoots off its own pair of wheels, and is quick to come into action. When travelling, the trail of the gun is hooked on to a two-wheeled ' limber '. The total weight behind teams, including the limber, should not generally exceed 1½ tons.

Many nations (e.g. Germany in 1914) consider that the difficulty of supplying two different rations of ammunition on the battlefield is a bar to the introduction of a special horse-artillery gun, and use the same gun as in field-artillery, lightening as far as possible and using a light limber. Other nations (e.g. Great Britain) have a specially light gun.

HORSE-ARTILLERY ARMAMENT

Country.	Calibre of Gun.	Weight of Shell.	Remarks.
British Empire	3 in.	12½ lb.	——
France	2·95 in.	16 lb.	Similar to field-artillery gun.
Italy	2·95 in.	14¼ lb.	Similar to field-artillery gun.
Russia	3 in.	14¾ lb.	——
Germany ..	3·03 in.	15 lb.	Similar to field-artillery gun.
Japan	2·95 in.	14¼ lb.	——

Horse-chestnut, a handsome genus of trees or shrubs (Æscŭlus) belonging to the nat. ord.

Sapindaceæ, having large opposite digitate leaves, and terminal panicles of showy white, yellow, or red flowers. *Æ. Hippocastănum* (the common horse-chestnut) is familiar to everyone. The seeds are large and farinaceous, and have been used as food for animals; they are bitter, and the bark also is bitter, astringent, and febrifugal. The tree is said to have been brought from Constantinople to England in the beginning of the sixteenth century, and is supposed to be a native of Northern Asia. Three other species are found in North America, where they are popularly known under the name of *Buck-eye*.

Horse-fly, the *Hippobosca equina*, a winged species of the family Hippoboscidæ, parasitic on the horse.

Horse Guards, or under the present official designation 'The Royal Horse Guards (The Blues)', were raised by Charles II in 1661, the first muster parade taking place at Westminster in February of that year. The Earl of Oxford was the first Colonel. During the 260 years of its existence the title of the regiment has been considerably varied from time to time. Starting as the Royal Regiment of Horse, the word Guards was soon added, and a little later it was known as the 'Blew' Guards. Then, after several other variations of title had been used, it became the 'Oxford Blues', and is at the present time invariably known as 'The Blues', though its full official title is as above. The Army List gives the uniform as "Blue, facings scarlet, plume red". Their cloak or overcoat is red instead of the more usual blue. In 1684 a contemporary publication quoted in Packe's *History of the 'Blues'* describes the uniform as follows: "The private men are distinguished by their carbine belts with gold upon buff with a red edging; hooses and holster caps with the royal cypher embroidered upon blew, coated and cloaked blew, lined red. . . ." The arms at this period were a sword, carbine, and two pistols, horse and arms being provided by the troopers themselves. The well-known cuirasses still worn in full dress were first taken into use for ceremonial purposes in 1821.

The battle-honours borne by the regiment are: Dettingen; Warburg; Beaumont; Willems; Peninsula; Waterloo; Tel-el-Kebir; Egypt, 1882; Relief of Kimberley; Paardeberg; South Africa, 1899–1900. The height for recruits of The Blues should be between 5 feet 11 inches and 6 feet 1 inch, and the age between eighteen and twenty-five.

The appointment of Colonel (not to be confused with that of the actual commanding officer of the unit, who is a regimental lieutenant-colonel) of the Blues, in common with that of the two regiments of Life Guards, is conferred on distinguished officers of the highest rank, and carries with it the duty of serving as Gold-Stick-in-Waiting at court. In the case of the Blues this honour was granted in 1820, in which year, by the king's command, the Blues were admitted to the "position and full privileges of the Household Cavalry", formerly only possessed by the two regiments of Life Guards. The duties of Gold- and Silver-Stick were, according to a writer of 1743, to attend week by week "on the king's person on foot wheresoever he walks from his rising to his going to bed: and this is performed by one of the four captains, who always waits immediately next to the king's own person, before all others, carrying in his hand an ebony staff or truncheon with a gold head engraven with His Majesty's cypher and crown. Near him also attends another principal officer with an ebony staff and a silver head. . . ."

The duty of Silver-Stick is now performed by regimental field officers other than the colonels of the regiments of Household Cavalry. At the present time H.M. the King is Colonel-in-Chief of the Blues, and Field-Marshal Earl Haig Colonel.

Horsens, a seaport in Denmark, east coast of Jutland, on a fiord of the same name, 25 miles s.w. of Aarhuus. It has manufactures of tobacco and a good general trade. It is the birth-place of Vitus Behring, the discoverer of Behring's Strait. Pop. 25,149.

Horse-power, a unit of rate of doing work, or of supplying energy. An engine which is developing 33,000 foot-pounds of energy per minute is said to be working at 1 h.p. The horse-power is therefore in all cases found by dividing the number of foot-pounds of work done per minute by 33,000. The term was introduced by James Watt, and was intended to represent the ordinary rate of working of a good horse. Later experiments have shown that the output of the best horses does not exceed $\frac{4}{5}$ h.p. *Indicated horse-power* is the power delivered by the steam to the piston of a steam-engine, or by the hot gases to that of a gas-engine. The power is measured by means of an indicator (q.v.), which draws a diagram showing the work done on the piston at each stroke. *Brake horse-power* is the horse-power output at the shaft of a steam-engine or an electric motor. This output is frequently measured and absorbed by applying a friction brake to a pulley on the shaft. The *horse-power hour* is a unit of energy equal to the work done at 1 h.p. in one hour. 1 h.p. = 746 watts. 1 h.p.-hour = 0·746 kilowatt-hour, i.e. 0·746 kelvin. See *Dynamometer*; *Unit.*

Horse-racing. Whilst historical evidence is to hand of equestrianism having been established in this country before the Roman conquest, the earliest mention of race-horses is in the ninth century. In the reign of Henry II races were frequent exhibitions, but it was not until the

time of James I that public races were to any considerable extent established, the best of which were called 'Bell courses' on account of the prize being a bell, from which circumstance has arisen the expression 'bearing the bell'. James I built stables at Newmarket, which were rebuilt by Charles II, and again in the middle of the last century by the Rothschilds. The restoration of Charles II gave a great impetus to horse-racing, and the reward of bells was superseded by that of silver cups.

From James I onwards racing has indeed been the sport of kings. Most reigning monarchs have not only patronized the sport, but as actual owners have contributed to the democratic spirit of sport by competing enthusiastically in the more important events. Queen Anne at York in 1712 ran horses in her own name. The late King Edward VII, who as Prince of Wales won the Derby with Diamond Jubilee in 1900, was again successful with Minoru in 1909.

Horse-racing of some kind or another is practised in this country throughout the entire year. The varieties are flat-racing, steeple-chasing, hurdle-racing, and trotting matches. It will be convenient to dismiss the last named first as a variety which, whilst exceedingly popular in America, has never captured the fancy in this country and is patronized by very few enthusiasts. The late Walter Winans, who died whilst actually driving in a trotting match, was exceedingly well known in this connection. A horse has trotted over 20 miles within an hour, and under exceptionally advantageous conditions in America has completed a mile in 1 minute 54½ seconds, but such speed has not been approached in this country.

A few general principles relating to race-horses will form a convenient introduction to the consideration of flat-racing. Flat-races are confined first to horses of a certain age, e.g. two-year-old or three-year-old, some for colts and fillies, or for fillies only. In these races the only handicap is what is known as sex allowance in racing parlance; thus colts carry 9 stones, fillies 8 stones 10 pounds. The principal two-year-old races are the Woodcote Stakes at Epsom, the July Stakes, Middlepark Plate, and Dewhurst Plate run at Newmarket, the Coventry Stakes at Ascot, and the Champagne Stakes at Doncaster. All these races are open to colts and fillies, and the winners of the classic events in the following year are generally found among the runners. Two-year-olds cannot run in a race exceeding 6 furlongs until September. It must be observed that the age of a race-horse dates from the 1st of January, no matter the day of birth; so that foals born in May are yearlings on the 1st of January following, although really only seven months old.

To proceed to three-year-old races, there are five classic events—three open to colts and fillies, and two to fillies only. The three former are the Derby (1½ miles) at Epsom, the Two Thousand Guineas (1 mile) at Newmarket, and the St. Leger (1¾ miles) at Doncaster. The races for fillies only are the One Thousand Guineas (1 mile) at Newmarket, and the Oaks (1½ miles) at Epsom.

The Derby, 'the Blue Riband of the Turf', is unquestionably the greatest sporting event in the world. It has been won only twice in the history of the race by French horses, viz. Gladiateur in 1865 and Durbar II in 1914. The record time for this race is 2 minutes 34⅘ seconds by Spion Kop in 1920, but this, of course, does not mean that no faster horse has won the race, as many conditions affect the time. (Incidentally it may be noted that the record for 1 mile is 1 minute 33⅕ seconds at Lingfield in 1920.) Whilst the form of every horse competing is intimately known and favourites predominate among those placed, it is interesting to note that three times in the history of the race the winner has been a 'rank outsider', starting with odds of 100 to 1 against. As would be expected, many Derby winners are successful in the other classic races of their year. Although the Derby was not run during the years 1915 to 1918 inclusive, it was regarded as essential in the interests of horse-breeding to preserve the sport by a substitute race held at Newmarket, and the same procedure was adopted in the case of the other classic events.

As regards handicap events, these are arranged on two plans. The first is weight for age, and is based on the principle that a three-year-old improves a stone up till the age of four, so that in April a three-year-old carries 7 stones 8 pounds over a mile, a four-year-old 9 stones; in October the latter still carries 9 stones, the former now 8 stones 7 pounds. Naturally this system of handicapping leads to discrepant results, as horses do not improve automatically with age. The principal three-year-old weight-for-age races are the Ascot Gold Cup (2½ miles), the Hardwick Stakes (1½ miles), both at Ascot, the Eclipse Stakes (1¼ miles) at Sandown, the Goodwood Cup (2¼ miles) at Goodwood, the Doncaster Cup (2 miles) and the Jockey Club Stakes (1¾ miles) at Newmarket. Entries for these races are made two or more months before the event; for the classic events entries are made when the horses are yearlings.

The other system of handicapping is an attempt to offer an equal chance to all competing by inflicting the handicap of weight according to the horse's previous or estimated form. It is clear that on this account a great deal of opportunity is afforded to backers to study the previous form of a horse and its opponents, and estimate its chances in a subsequent race, bearing in mind its present handicap. The weights, as a rule, run from 9 stones down to 6 stones; the principal handicaps are the Cesarewitch (2¼ miles), the Cambridgeshire (1 mile 1 furlong), both at Newmarket, the Lincoln Handicap, the City and Suburban, the Chester Cup, the Jubilee Cup, and the Manchester Cup, and a large number of others too numerous to mention.

Steeple-chases and hurdle-races are more usual in the winter months, the most important of all being the Grand National at Aintree, near Liverpool. This is over a course of 4 miles 1000 yards with thirty jumps, the water-jump being 15 feet wide; yet such is the stamina of the steeplechaser stock that the average winning time is as little as 10 minutes 13 seconds.

The chief racing meetings other than Newmarket and Epsom are Goodwood, which is a curiously private affair, the whole *mise en scène* belonging to the House of Richmond, the reigning representative of which can exercise his prerogative to permit the races to be run; Ascot, Sandown Park, Doncaster, and Chester. There is a big social element in these meetings, particularly Ascot and Goodwood.

The rules guiding flat-racing in Britain are framed by the Jockey Club, a body with absolute power, founded in 1750. A French Jockey Club performs the same function in France, where the principal races are the Prix de Diane (the French Oaks) and the Prix du Jockey Club (the French Derby), run in the spring at Chantilly, which is regarded as the Newmarket of France and is 25 miles from Paris; the Grand Prix de Paris, run at Longchamps in the Bois de Boulogne in June; and the Grand Steeple de Paris, run at Auteuil, also in the Bois de Boulogne, in June. Frequent meetings are held at Longchamps, Auteuil, St. Cloud, Maisons-Laffitte, &c.

The biggest price ever paid for a race-horse is £40,000, but £30,000 has been paid on several occasions. The lightest jockey on record weighed only 2 stones 1 pound, an impossibility since 1860, when the minimum was fixed at 5 stones 7 pounds, and in any case the Education Act prevents boys under twelve from being engaged in a racing stable.

Even to the present day the reputation survives of Eclipse (foaled in 1764) as the fastest horse on record, although the speed attributed to this animal and to Flying Childers (1715) seems incredible in the light of accredited modern achievements.

The breeding and training of thoroughbreds is too complicated a subject to justify more than a passing mention. The recognition of certain strains and the suitability of admixture with others is an art which perhaps rests upon an empirical rather than a scientific basis. and many disappointments ensue as a consequence. In the same way many surprises are in store for a trainer. Horses are not the mere machines which the general public is inclined very often to suppose. Some horses come to maturity very slowly and do not show any striking form until their fourth or fifth year; others reach maturity very quickly and are best as two-year-olds; others, again, seem at a critical period to find their form suddenly. And in these respects highly experienced trainers, like everybody else, are prepared for mistakes in either direction.

At the moment of writing, the world of sport is highly exercised by recent legislation on the question of betting, and the position of a backer who has paid by cheque.—BIBLIOGRAPHY: Sir John Dugdale Astley, *Fifty Years of Sport at Home and Abroad*; A. E. T. Watson, *The Racing World and its Inhabitants*; Finch Mason, *Heroes and Heroines of the Grand National*; T. A. Cook, *History of the English Turf.*

Horse-radish (*Cochlearia Armoracia*), a cruciferous plant inhabiting the temperate parts of Europe, in moist situations. The root is cylindrical, whitish in colour, and forms a well-known condiment, possessing a pungent taste and odour. It is also employed medicinally, as a stomachic, diaphoretic, and diuretic, and externally as a rubefacient.

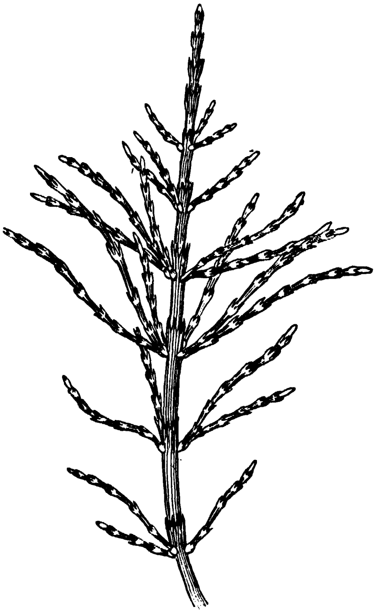
Horse-radish Tree, an Indian tree (*Moringa pterygosperma*) having pinnate leaves and long three-valved pod-like capsules, from which an oil called *ben-oil* is obtained. The fresh root has a pungent odour and warm taste, much like that of a horse-radish.

Horseshoe, a shoe for horses, consisting commonly of a narrow plate of iron bent into a form somewhat resembling the letter U, so as to accommodate itself to the shape of the horse's foot. Horseshoes do not appear to have been known to the ancients, though there are a few references to shoes for mules (e.g. Catullus, *Carmen*, xvii, 26). Xenophon, Vegetius, and others mention various processes for hardening the hoofs so as to make them stronger, but say nothing of any protection like the horseshoe. Iron horseshoes are mentioned as being in use in Europe in the ninth century of our era. They seem to have been introduced into England by the Normans. The belief in the horseshoe as a protection against evil spirits is widely spread in Germany, Scandinavia, Great Britain, and the United States. This belief is referred to by Butler in *Hudibras*: " Chase evil spirits away by dint Of sickle, horse-shoe, and hollow flint ".

Horseshoe Vetch (*Hippocrepis comosa*), a British leguminous herb, characteristic of chalky soils. It is not unlike bird's-foot trefoil, but the pods are very distinctive, being composed of many one-seeded joints, each curved into the shape of a horseshoe.

Horse-tail, the general name of plants of the genus Equisetum, nat. ord. Equisetaceæ. The cuticle abounds in silica, on which account the stems of some species are used for polishing wood. *E. hiemāle,* the greater rough horse-tail or Dutch rush, is best fitted for that purpose, and is largely imported from Holland. Several species are natives of Britain.

Horse-tail, among the Turks and other Eastern nations, the tail of a horse mounted on a lance, and used as a standard of rank and honour. The three grades of pashas were distinguished by the number of tails borne on their standards, three being allotted to the highest dignitaries or viziers, two to the governors of the more important provinces, and one to those of less important districts.



Horse-tail (*Equisetum arvense*)

Horsforth, a town of England, West Riding of Yorkshire, on the Aire, 4 miles north-west of Leeds, with woollen manufactures, &c. Pop. (urban district), 9175.

Horsham, a town of England, in the county of Sussex, on a branch of the River Arun, 37 miles S.S.W. of London, and 22 miles N.W. of Brighton, giving name to a parliamentary division of the county (Horsham and Worthing). Christ's Hospital, removed from London in 1902, is here. Pop. 11,413.—*Horsham* is also the name of a town in Australia, north-west of Melbourne.

Horsley, Samuel, English bishop, born 1733, died 1806. He was educated at Cambridge, and in 1759 became rector of Newington Butts. In 1767 he was chosen a Fellow of the Royal Society, of which he was appointed secretary in 1773. After several charges he was appointed in 1788 Bishop of St. David's, from which he was translated to Rochester in 1793, receiving at the same time the deanery of Westminster; and finally to St. Asaph in 1802, when he resigned his deanery. Dr. Horsley was the greatest theological controversialist of his day, and is famous for his controversy with Priestley on Unitarianism. He published numerous sermons, and several works on Biblical criticism, besides editing an edition of Sir Isaac Newton's works.

Horsley, Sir Victor Alexander Haden, British surgeon and neurologist, born at Kensington 14th April, 1857, died in Mesopotamia of heat stroke 16th July, 1916. He studied medicine at University College Hospital, London; was professor superintendent of the Brown Institution from 1884 to 1890; Fullerian professor at the Royal Institution from 1891 to 1893; professor of pathology, University College, from 1893 to 1896; and professor of clinical surgery at University College Hospital. A specialist in facial surgery, he was surgeon to the National Hospital for Paralysis and Epilepsy from 1886 to 1916. He was knighted in 1902. During the European War he went to Mesopotamia in 1916, where he served as consultant to the British forces. He was one of the leaders of a medical movement against alcohol, and a champion of women's suffrage. His numerous works include: *Brain Surgery, Hydrophobia and its Treatment, Experiments upon the Functions of the Cerebral Cortex,* and *Alcohol and the Human Body* (with Dr. Mary Sturge).

Horta, a town in the Island of Fayal, one of the Azores, on the shores of a small bay between two rocky headlands. It has a good harbour, and exports wine, oranges, and grain. Pop. 6057.

Hortensius, Quintus, Roman orator, born of an equestrian family 114 B.C., died 50 B.C. He held many military and civil offices, and was elected Consul for the year 69 B.C. In the previous year he had been engaged to defend Verres during the famous prosecution in which Cicero acted for the accusers. Hortensius continued to maintain a generous and friendly rivalry with Cicero, acknowledging his superior oratorical powers without jealousy. His speeches are all lost.

Horticultural Societies, societies formed for the encouragement of both the art and the science of the cultivation of garden plants. The Royal Horticultural Society of London, the first of its kind, was founded by Sir Joseph Banks and others in 1804. It has about 13,000 members, associates, and fellows, and its research station is in the gardens at Wisley, Surrey, presented in 1903 by Sir Thomas Hanbury.

Horticulture (from Lat. *hortus*, garden, and *colere*, to till), or **Gardening**, includes, in its most extensive signification, the cultivation of esculent vegetables, fruits, and ornamental plants. It may be regarded as a specialized branch of agriculture, and in so far as it is concerned with flowers and shrubs differs from this in being of non-utilitarian character. In large gardens there are generally separate departments for flowers, fruits, and vegetables; but in small gardens they are usually more or less combined. A garden should be either on a level, but admitting of effectual drainage, or on a gentle slope, preferably on the lower portion of a slope facing the sun. It should be well sheltered, either naturally from situation, or artificially by means of plantations, or walls. The character of the soil is of much importance. A good loam, or a sandy loam mixed with humus, is the best. The former is better fitted for fruit-trees, but for early crops the sandy loam is desirable. Whilst the greater part of a garden should consist of such soil, either naturally or artificially formed, it is useful to have a portion stronger and another much lighter in order to suit the requirements of different plants. The nature of the subsoil is also important. The best is a dry bed of clay overlying sandstone. Digging, ploughing, and pulverizing the soil, and exposing the surface to the action of the summer sun and the winter's frost, are highly useful operations, by which the tenacity of stiff soils is overcome, weeds and insects are destroyed, and a quantity of air is admitted into the ground. Nutritive matter is frequently supplied to plants in the form of manure, either organic or inorganic. After the soil is properly dry and pulverized, the seeds are deposited, and this should always be done in dry weather, for a dry soil is especially requisite for covering in the seeds. Watering is often necessary as a means of nourishment to growing plants, especially as a support to newly-transplanted vegetables, and for cleaning the leaves and destroying insects. The methods of propagating plants are various. For an account of the processes of budding and grafting see these articles. Another mode of propagation is that by means of cuttings, or shoots cut off and planted in the soil, where they take root. This process is exceedingly simple and easy in the case of many trees, as the willows and poplars; but requires some management in the heaths, myrtles, and other shrubs. When it is a question of producing new varieties, whether of vegetables or flowers, artificial cross-pollination is largely employed. Desirable ' sports ' are also carefully picked out, and made the starting-point for new races. In growing ornamental plants and flowers and exotic fruits, plant-houses of various kinds are necessary. These comprise the numerous forms of conservatory, plant-stove, greenhouse, pits, and frames. The tools, implements, and machinery used are very various. The subject is now taught in agricultural colleges, and excellent textbooks, such as Thompson's *Gardener's Assistant*, exist. —BIBLIOGRAPHY: L. H. Bailey, *Standard Cyclopædia of Horticulture*; W. P. Wright, *Illustrated Encyclopædia of Gardening*; K. L. Davidson, *Gardens Past and Present*.

Horus, the Latinized name of two Egyptian divinities. The elder was the son of Seb (identified by the Greeks with Kronos) and Nu (Rhea) and brother of Osiris. The other was the son of Osiris and Isis. On the death of Osiris he was his avenger, defeating the serpent Typho, and enabling Isis to thwart his wicked designs. Both the elder and the younger Horus were regarded as symbols of the sun.

Horwich (ho'rich), a town (urban district) of England, in South Lancashire, 5 miles west by north of Bolton, with cotton mills, dyeworks, railway works, collieries, quarries, &c. Pop. 16,286.

Hosanna, a word composed of two Hebrew words occurring in *Psalm* cxviii, 25, *hoshia-na*, signifying ' save now '. The psalm was sung on joyful occasions, and particularly at the Feast of Tabernacles. The phrase is used as an exclamation of praise to God, or an invocation of blessings. *Hosanna* is the cry with which Jesus was greeted at His last entry into Jerusalem.

Ho'sea, the first in order among the minor prophets of the Old Testament, but probably the third in order of time, flourishing about 750 B.C. Nothing is known of his life, except that he was the son of Beeri, and that his ministry belonged to the reigns of Uzziah, Jotham, Ahaz, and Hezekiah, Kings of Judah. The nation generally and the ten tribes in particular are reproved, exhorted, and threatened in his prophecy. He predicts the approaching exile of his countrymen, and their subsequent return and greater prosperity.

Hoshangábád, chief town and head-quarters of district of the same name, Central Provinces of India, on the Nerbudda. It is a chief seat of the British piece-goods trade, and does business in cotton and grain. Pop. 5500.—The district has an area of 3688 sq. miles, and a pop. of over 450,000.

Hoshiarpur, chief town and seat of administration of district of same name, Punjab, India. Pop. 17,500.—The district has an area of 2244 sq. miles, and a pop. of about 920,000.

Hose refers to footwear used by ladies, the term half-hose being given to the socks worn by men. The chief divisions of the trade are as follows: *Seamless* hose are produced on circular machines and made automatically from start to finish, the toes and heels being worked in pocket form, and when the machine completes the article, all that is necessary is a short joining of raw loops across the toe. *Full-fashioned* hosiery is produced on flat machines where the article is made in a flat piece at double width, and the fullest interpretation is given to the shape of the article, narrowing in from the calf towards the ankle and giving a heel and toe of adequate roominess. By this system it becomes possible to make articles exactly to the required size and shape, but the flat piece has afterwards to be seamed down the back of the leg and along the foot. In regard to making the foot, there is the *French* style of foot, where a seam or join is made along the bottom of the instep, which creates a raised part due to the seaming thread at the part of the foot which is usually rather sensitive. The *English* foot has the join made along each side of the foot, and the sole portion is thus left plain and gives greater comfort to the wearer. Certain types of hosiery, notably half-hose, are made with the top part in ribbed stitch to give a greater grip on the leg and keep the article in position, and till recently this has been made on a separate machine from the hose proper, having to be transferred or joined. Recent important improvements have made it possible for the rib top and the plain leg and foot to be made entirely automatically on one and the same machine. In the case of full-length hose the top is made in two-ply fabric folded over, and this can be automatically turned and joined to the hose in the machine under the term of 'automatic welt'. A new improvement affects the making of luxury hose from expensive materials such as silk and artificial silk, where it is possible to make the heel, toe, and under part of the foot in a thicker count of woollen yarn, whilst the top of the foot and the leg are of silk. This is a much-valued improvement because the thicker yarn at the heel and along the sole of the article gives a much longer period of service, and the use of expensive materials at those places is obviated.

Hose-piping, a heavily woven circular or seamless pipe, used extensively by the members of fire brigades and the like for conveying water to extinguish the fires of burning buildings. It is made invariably of linen or flax yarns, and woven on the double plain principle of weaving to obtain the circular section of cloth. Such fabrics are made both in hand looms and in power looms, the hand-made article being generally admitted to be the best, because the weft is beaten up both with the shuttle in the shed and out of it, and the renewals of weft are arranged for the ends to overlap each other. Special types of looms, shuttles, and reeds are made for the weaving of hose-pipe, and the finished product must obviously be perfect if it is capable of sustaining the usual high pressure of water (500 to 1000 lb. per square inch) from the mains. Both warp and weft yarns are level, multiple-ply, twice boiled, and beetled to ensure strength and flexibility. After the cloth is woven, it is steeped in a bath of copper sulphate, during which a shrinkage takes place; it is then dried in an artificially heated room. When the necessary unions and nozzles are fitted to the ends, the fire-hose is ready for use.

Hosiery, a term which originally referred to the making of footwear, which was the first branch to be taken up in the knitted stitch. In recent years there has been a great extension of the use of this fabric for underwear, outerwear, and intermediate garments, and all these various branches are loosely included under the generic term of hosiery. These extended uses of the knitted fabric have been made possible by the great improvements made in knitting machinery, where the original plain stitch has been elaborated so that fabrics of the most fancy description are produced. Attachments have been made to underwear and hose machines which make it possible to produce very intricate open or lace designs on garments intended for evening wear; shirtings have been greatly enhanced in their appearance by the use of vertical and horizontal stripes, and the Jacquard attachment has been adapted to producing lace and striped effects with the freest kind of floral patterns. The plain stitch in itself is often too thin and light for many purposes, but the devices added to most knitting-machines make it possible greatly to increase the weight and thickness of the fabric, thus achieving greater warmth and giving the fabric a much wider application than its use for footwear and underwear. Fleecy-backed fabrics are largely employed for garments where a bulky handle and a soft brushed effect is required inside. There has recently been a great advance in the fine textures which can be produced on the knitting-machine, and the latest developments lie in the direction of the use of fine pure silk and artificial silk. Hosiery-trade production is proving more and more a serious rival to the older industry of weaving, owing to the ease with which the fabric can be produced, and also to the fact that most manufacturers are in direct touch with the public and produce the garments ready-to-wear. The trade in knitted novelties such as knitted caps, ties, scarves, and vests is assuming ever larger proportions, and now forms a staple part of the clothing production of each season. The rawness with which the knitted stitch was formerly associated for certain classes of goods has been largely eliminated by the perfection of our present-day brushing machines, which can produce a nap on cotton goods to give them an appearance approaching wool; in woollen goods very elegant effects can be produced from long-fibred yarns worked in fancy colours, where the fibre is drawn to the surface to obscure the rawness of the loops and give a desirable *mélange* to the colour scheme. The small-diameter knitting-machine has been greatly developed for the production of knitted ties, and a promising branch is that of making narrow tubular fabrics suitable for edging garments to enable them to keep their shape in wear; these can also be used with good effect as decorative agents in many types of garments. An increasing trade is being done in knitted fabrics cut into costumes and blouses, and the material for this work is now sold in web form ready to be cut into garments similar to woven cloth; great advances have been made in trimming these garments so as to prevent abnormal stretching of the fabric during wear. The knitted stitch lends itself to the production of open gauzy textures, often used for indoor wear and for intermediate garments, calculated to increase the heat-retaining power of ordinary woven clothing.

Hospital (Lat. *hospitalis*, pertaining to a host or entertainer), an institution for the treatment of disease and injuries, to which may be added the even more important functions of training doctors and nurses, and the prosecution of medical research. The term *infirmary* is sometimes used in a similar sense, but there is a tendency in Britain to restrict it to rate-supported institutions. Hospitals take origin from very remote times, and long before the Christian era a commencement in this direction was made in Greece, Egypt, and India. At a later period a number of them were founded in Bagdad by Harun-al-Rashid (A.D. 763–809). In England a leper asylum was erected in London in 1118; St. Bartholomew's Hospital dates from 1123, and St. Thomas's from 1200. The last two institutions were the only metropolitan hospitals at the beginning of the eighteenth century, and the provinces were at that time still more backward in provision for the sick. There are now over a dozen great general hospitals in London, making provision for cases of all kinds, and possessing more or less adequate arrangements for training and research; and a large number of smaller institutions, many of them devoted to special diseases, or meeting the medical requirements of women and children. The provinces are also, for the most part, well provided with hospitals, those in the more important centres having medical schools attached and engaging in medical research. The hospital system has also been adequately developed throughout the British Empire and in many foreign countries.

On the Continent and in the United States it is usual for hospitals to be subsidized and administered either by the State or by municipalities. This method not only prevents the work from being hampered and restricted by financial difficulties, but also enables an ordered system to be adopted for the convenience of the whole community, while at the same time economizing energy. But it tends to the establishment of a dull, mechanical, soulless routine, a lowering of efficiency, owing to the absence of vigorous criticism, and wasteful expenditure of public funds. Medical research, moreover, is apt to languish in such an atmosphere. Fever and smallpox hospitals, however, are best placed under public control, as in this country, for the spread of infection can only be satisfactorily checked by a compulsory and rigid system.

The advantages of the voluntary system are many, and it is undoubtedly well adapted to the temperament and traditions of the British people. It is of necessity associated with vigorous criticism, and this conduces to economy in administration and efficiency in methods of treatment. The doctors and nurses trained at one of our great general hospitals attain a higher standard from year to year, and the atmosphere of medical research prevents instruction from becoming sterile and stereotyped. But the maintenance of the voluntary system will prove difficult if not impossible unless the finances of our hospitals are put on a thoroughly sound footing, and at the present time (1922) expenditure is in most cases far in advance of the income derived from endowments, grants, payments, subscriptions, and donations. Hospitals were established at a time when the distinction between classes was very sharply marked, and their object was to relieve the sufferings of the extremely poor. Large numbers of patients do not now come under that category, and these are now required to contribute towards the cost of maintenance according to their means, the medical treatment remaining free. It is found that patients are not only willing but anxious to do this, and those among the professional and middle class unable to afford specialist treatment are availing themselves in increasing numbers of the facilities offered by hospitals, it being no longer a question of receiving ‘ charity ’. Some hospitals even have ‘ paying wards ’, where no financial obligation is incurred and greater privacy is secured than in ordinary wards. Payments by patients, however, though easing the situation, do not remove the necessity for a very large increase in subscriptions and donations, especially as it will always be necessary to provide for those unable to make even a small contribution.

King Edward's Hospital Fund, founded in 1897, has proved a great financial boon to

London hospitals, and has also been a valuable check on methods of administration, for the conditions attached to grants and the comparisons made between institutions have undoubtedly promoted rigid economy in no small degree.

Those possessed of large means can do much for hospitals by endowing professorial chairs, research laboratories, wards, and beds; and it seems an anomaly that such endowments, when taking the form of bequests, should be subject to legacy duty. Valuable contributions are also made by such voluntary associations as the Hospital Sunday Fund and Hospital Saturday Fund; but by far the most important source of income consists of annual subscriptions given by firms and individuals, and of regular collections organized by employees. In this respect a provincial city or town is fortunately situated, for it is a co-ordinated community in which co-operation is easily possible and conflicting claims are not too numerous. Leicester, for example, has been able to run its own medical services by well-organized concerted action. London, however, presents a gigantic problem for solution, and one of unique difficulty. It may be that in course of time we shall see the metropolis properly organized into districts, each with its own great general or key hospital, associated with smaller institutions of more specialized kind. Much waste of force and overlapping would thereby be avoided. We may take as an example the great and wealthy borough of St. Marylebone. For this the general hospital is the Middlesex Hospital (founded in 1745), with a flourishing medical school, cancer research laboratories, and the Bland Sutton Pathological Institution. There are also nine smaller hospitals of special character. Taken together, these ten institutions provide a complete system of medical services, which could easily be maintained and extended by the abundant resources of the borough. — BIBLIOGRAPHY: Sir H. Burdett, *Hospitals and Asylums of the World* (with supplements); Sir Douglas Galton, *Healthy Hospitals*; *Annual Reports* of individual hospitals.

Hospital Fever is fever arising in hospital on account of insanitary or septic conditions. It was at one time very common in hospitals, but is now extremely rare. Up to the middle of last century this name was also used for many cases of typhus fever.

Hos′podar, or **Gospodar,** a title of dignity formerly borne by the vassal princes of Moldavia and Wallachia from the fifteenth century to 1866, and in earlier times by the princes of Lithuania and the kings of Poland down to John Sobieski. The word is connected with *gospod* and *gospodin* in the various Slavonic languages, and meaning *master*.

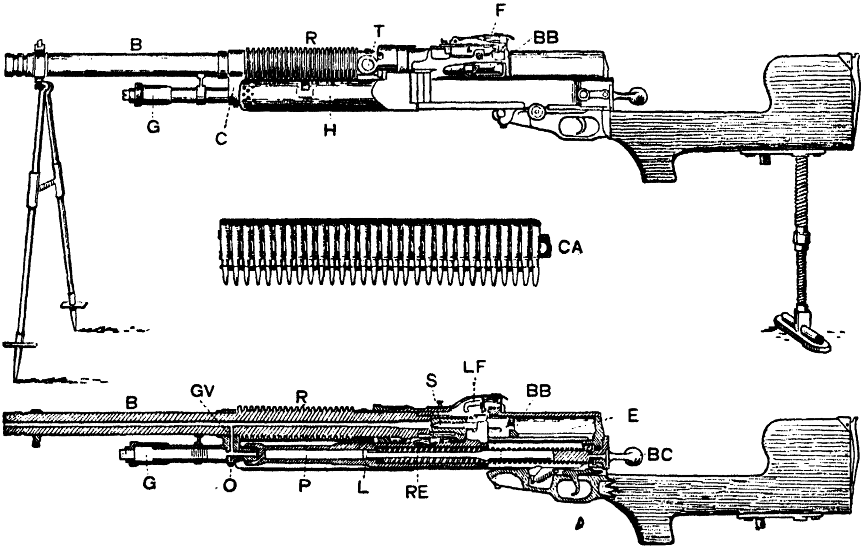
Host (Lat. *hostia*, a sacrificial victim), a term used for the bread (or wafer) and wine in the eucharist, as containing the body and blood of Christ. As the wafer alone is given to laymen in the Roman Catholic Church, as containing both the body and blood of the Redeemer, the term *host* is usually applied to the consecrated wafer. See *Elevation*; *Mass*; *Transubstantiation*.

Hostage (O.Fr. *ostage*, Fr. *ôtage*), a person left as pledge or surety for the performance of the articles or conditions of a treaty. The taking or giving of hostages is now scarcely known in the relations of modern communities, but was formerly almost universal, and many questions in the law of nations arose out of the practice. If the stipulated terms were observed, the hostages were returned on each side, but if the terms were violated or evaded, the hostages might be put to death.

Hotchkiss-gun, a small machine-gun used by cavalry and tanks. In action the Hotchkiss is easily concealed, and can be used in much the same way as an ordinary rifle, the calibre and ammunition used being the same. Normally three men form the gun detachment for firing purposes, but on emergency it can be worked by one man, and, carried dismounted, can hardly be distinguished from a rifle at a distance of a few hundred yards. It is, in fact, an automatic rifle, and its ‘effective’ range, i.e. from 1400 to 600 yards, is considered to be the same as that of a Lee-Enfield. Its weight is 27 pounds, and it is therefore considerably lighter than an ordinary machine-gun, and consequently not so steady when firing.

The gun consists of two main portions, called respectively the stationary and the moving portion. Roughly speaking, the stationary portion consists of the barrel (herein differing from the Vickers-Maxim machine-gun), the body, the trigger mechanism, the cocking-handle, and the butt; while the moving portion comprises the piston-rod, the breech-block with firing-pin, the feed-piece, and the recoil spring. To load the gun the cocking-handle is brought into operation, and one end of a metal ‘feed-strip’ containing thirty cartridges inserted into the feed-piece. Then the pressure on the trigger sets the mechanism in motion, and the gun is fired. After this two main forces act on the mechanism: the gases generated by the explosion of the cartridge working in a controlled direction act on the head of the piston-rod and force it back; this piston-rod is placed underneath the barrel, and in its backward journey it engages with a part of the feed-piece and moves it to the left, bringing a fresh cartridge into position; the piston-rod also acts on the breech-block and prepares it for firing. When the piston-rod has reached its farthest back position, the recoil-spring takes charge and forces the piston-rod forward. In its forward journey the piston-rod again engages with the breech-block, which in its turn forces the cartridge presented by the movement of the feed-piece into the chamber, the firing-pin being released at the same moment and exploding the cartridge. The empty case of the preceding round is automatically withdrawn, and ejected through an aperture on the left of the gun during the first or backward movement of the piston-rod.

The mechanism of the gun is so arranged that by a simple adjustment it can be used for single shots or for continuous fire. In the former case the trigger must be pressed for each shot, while in the latter it is only necessary to retain a pressure on the trigger and the gun will fire as long as there are cartridges in the feed-piece.



Hotchkiss-gun

A, Trigger. B, Barrel. C, Cylinder. BB, Breech-block. CA, Feed-strip containing 30 cartridges. R, Radiator rings for cooling the barrel. T, Trunnion. F, Feeding-piece. G, Gas regulator. H, Hand-guard. GV, Gas vent. O, Orifice screw. P, Piston-rod. L, Lugs of cocking-handle. RE, Recoil-springs. S, Striker. LF, Lever of feed-piece. E, Receiver. BC, Cocking-handle.

Normally the gun is carried on a pack-horse led by a mounted man, while three other mounted men form the gun detachment proper. When necessary, the pack-horse can be dispensed with and the gun carried on the horse of one of the detachment. It can also be carried on a specially-fitted bicycle. When carried normally, the pack-horse also carries 1200 rounds of ammunition and certain spare parts; more ammunition, making up a total of some 2000 rounds all told, is carried on the horses of the detachment.

Hotchpot, in English law, a term applied to the act of a claimant on a fund, who, in order to be entitled to a share, brings into account payments previously made to him. Thus if a daughter A has received £2000 from her father as a marriage portion, and a son B £3000 to commence business, and if thereafter the father dies intestate leaving £10,000 and another child C, then if A and B desire to share in the estate they must bring into hotchpot the £5000 they have received. The share of each child is then £5000, of which A has already received £2000 and B £3000. A, therefore, now receives £3000, B £2000, and C £5000.

Hôtel de Ville, the French name for a town hall. The old Hôtel de Ville in Paris, begun under Francis I and completed under Henri IV in the sixteenth century, was destroyed in 1871 during the Commune. It was replaced by a new building, erected by the architects Ballu and de Perthes, which is one of the finest examples of modern architecture. It is in the French Renaissance style and rectangular in shape. Its imposing façade is enriched with allegorical groups and statues typifying French cities.

Hot'tentots, a peculiar African people, supposed to be a cross between the Bushmen (the primitive aboriginal race of South Africa) and the Bantu negro. The most obtrusive evidence of the Bushman element is provided by the colour of the skin and the peculiar hypertrophy of the buttocks known as steatopygia. In former times they and the Bushmen are supposed to have occupied Africa as far north as the Victoria Nyanza; but they have gradually been pushed to the south by the Bantu and then north-west by the European settlers at the Cape. When young they are of remarkable symmetry; but their faces are ugly, and this ugliness increases with age. The complexion is a pale olive, the cheek-bones project, the chin is narrow and pointed, and the face consequently is triangular. The lips are thick, the nose flat, the nostrils wide, the hair woolly, and the beard scanty. When the Dutch first settled at the Cape in the middle of the seventeenth century, the Hottentots were a numerous nation, of pastoral and partially nomadic habits, and occupied a territory of 100,000 sq. miles. At the present day this race is nearly extinct within the wide territory which formerly belonged to it, having been entirely hunted out and dispersed by the Boers. Amongst the offshoots of the Hottentot race are the Griquas, descended from Hottentot mothers and Dutch fathers, giving name to the districts Griqualand East and West. They are semi-civilized, and have towns or villages. The Koras or Korannas, about the middle of the River Orange, are favourable specimens of the Hottentot race. They are taller, stronger, and more cleanly than the tribes farther west. Other tribes are the Gonas or Gonaquas, much mixed with the Amakosa Kaffirs; the Namaquas, dwelling towards the mouth of the River Orange; the Hill Damaras, farther north. The Bosjesmen or Bushmen are a more primitive people than the Hottentots. Dr. Robert Broom is inclined to regard the Korannas, Bushmen, and Hottentots as distinct races, of which the Korannas are the most primitive. The language of the Hottentots is peculiar, consisting of a system of clicks or clucks.—BIBLIOGRAPHY: P. Kolben, *The Present State of the Cape of Good Hope*; Sir John Barrow, *Travels into the Interior of South Africa*; E. Holub, *Seven Years in South Africa*; G. W. Stow, *Native Races of South Africa*.

Houghton (hō'tun), Richard Monckton Milnes, Lord, only son of Robert Pemberton Milnes, of Fryston Hall and Great Houghton, was born in Yorkshire in 1809, and died in 1885. Educated at Cambridge, he made some reputation as a writer of verse, essays, memoirs, &c., but it was rather his social and conversational powers, and his kindly patronage of literary aspirants, than the merit of his writings which gave him his prominent position in London society. In 1837 he entered Parliament as member for Pontefract, at first as a Tory, but afterwards as a supporter of Russell and Palmerston. He was an active member of numerous learned societies and institutions, president of the Royal Society of Literature, trustee of the British Museum, and foreign secretary of the Royal Academy. The best-known work by Lord Houghton is his *Life of Keats* (1848), in which he finally removed many popular misconceptions about the poet.

Houghton-le-Spring, a market town of England, in the county of Durham, 6½ miles N.E. of Durham. Its prosperity depends on the numerous coal-mines in the neighbourhood. Bernard Gilpin was rector of the parish from 1556 to 1583. Houghton-le-Spring gives name to a parliamentary division of the county. Pop. 10,205.

Hound (*Canis sagax*), a name given generally to hunting dogs; but restricted by scientific writers to such as hunt by scent, a definition which excludes the greyhound. Amongst the varieties are the bloodhound, staghound, foxhound, harrier, and beagle. Hounds are distinguished not only by their fineness of scent, but by docility and sagacity. Of the rough-haired and smooth-haired varieties the former manifest the greater affection for man.

Hounslow, a town of England, in Middlesex, 9 miles south-west of Hyde Park Corner, London. The adjoining Hounslow Heath, once notorious for the highway robberies committed on it, is now entirely enclosed, and is the site of large cavalry barracks and extensive powder-mills. Pop. 16,560.

Hou-Pe, Hu-Peh, or **Hoo-Pe** (North of the Lakes), a central province of China. It is intersected by the Han-kiang and the Yangtze-kiang, and is considered one of the most fertile parts of the republic. Pop. 24,900,000.

Hour, the twenty-fourth part of a day. In most countries the hours are counted from midnight to mid-day, and twelve hours are twice reckoned. Some Continental and British foreign military time is reckoned as 24 hours, one day; e.g. 8 a.m. is written 0800 hours, and 9 p.m. would be stated as 2100; 9.30 p.m., 2130 hours, &c. See *Day*; *Time*.

Hour-glass, an instrument for measuring time, consisting usually of two hollow bulbs placed one above the other, and having a narrow neck of communication through which a certain quantity of dry sand, water, or mercury is allowed to run from the upper to the lower bulb, the quantity of sand being adjusted so as to occupy an hour in passing from one bulb to the other. The hour-glass was commonly used in churches during the sixteenth and seventeenth centuries to regulate the length of the sermon.

Houris (hou'riz or hō'riz), the 'black-eyed' nymphs of Paradise, whose company, according to the *Koran*, is to be one of the rewards of the faithful. They are described as most beautiful virgins, endowed with perpetual youth, and subject to no impurity. They are made not of clay, but of musk, saffron, incense, and amber. They dwell in beautiful gardens, by flowing streams, and the very meanest of the faithful will have at least seventy-two of them. Later Mahommedan theologians endeavoured to give an allegorical explanation of the houris.

House. In point of law, the common expression, "an Englishman's house is his castle", is in most instances true. Except where there has been a criminal offence, an Englishman can hold his house against all comers. No bailiff can break open his door to arrest him, or to seize his goods for debt, nor can any court give him this power; but if a bailiff is once permitted to enter he cannot be expelled. Scottish law does not give the householder such a strong position. A Scottish court can give a messenger permission to force a door, and arrest or distrain as may be wished. Breaking into a house by night with the intent to rob is *burglary*.

House-breaking, in English law, is the crime of breaking and entering into a house or other building between the hours of 6 a.m. and 9 p.m. with intent to steal. 'Breaking and entering' are constituted by forcibly picking a lock or smashing a window, or by any unusual mode of entry without force. If committed by night the crime is burglary.

House-fly. See *Fly*.

Household Suffrage, suffrage based on the occupancy of a house or a distinct part of a house. In Britain it was established in boroughs by the Reform Act of 1867, and extended to the counties in 1884. Lodgers occupying lodgings which would let unfurnished for £10 a year were also entitled to rank under this suffrage. It is now regulated by the Representation of the People Act, 1918.

Houseleek (*Sempervīvum tectōrum,* nat. ord. Crassulaceæ), a succulent plant, common in Britain, and growing on old walls, the roofs of cottages, &c. The stem rises to the height of 8 or 10 inches, and bears a few purplish flowers, which have twelve or fifteen petals. The leaves are sometimes applied to bruises and old ulcers.

Housemaid's Knee, acute inflammation of the bursa or sac between the knee-pan and the skin, so called because it is common amongst housemaids from their kneeling on hard floors. But it may occur in anyone whose knee is exposed to repeated irritation. It usually develops suddenly, and the knee becomes hot, swollen, and tender. It is treated like other local inflammations by rest and fomentations in the early stages. But if neglected it may result in the formation of an abscess, which is liable to involve the bone or even the joint.

House of Commons. See *Parliament.*

House of Lords. See *Parliament.*

Housing. The problem of housing existed long before the European War of 1914–8, and its origin may be found in the industrial revolution which, beginning in the later part of the eighteenth century, led to the sudden growth of small villages into industrial centres with large populations. To accommodate these masses, houses were erected without regard to any plan or system. The result was overcrowding, congested housing, and insanitary conditions. Two problems thus arose, viz. to direct the future growth of towns along right lines, and to reform what existed.

Legislation for housing reform dates from the middle of the nineteenth century. The earlier measures were mainly of a negative character, and gave public authorities power to proceed against the owners of bad property for the removal of nuisances. Then in 1874 they were allowed to grant or lease land for the erection of workmen's dwellings, and in the following year, under the Cross Act, authority was given to them to undertake large housing schemes. The Housing of the Working Classes Act of 1890 followed. Part I of the Act deals with great clearance and re-housing schemes to be carried out by local authorities; Part II provides for the improving and suppression of the insanitary conditions of single houses or small slums; Part III gives local authorities powers to acquire land by compulsory purchase and contract loans for the erection of new dwellings. Little use was, however, made of the powers given until after 1900.

The Housing and Town Planning Act of 1909 extended the powers already given, and strengthened the hands of the Government for enforcing execution of the Housing Acts.

In the earlier attempts at dealing with the problem of housing nothing was done in the way of laying down rules to guide the development of sites. It was only after 1890, and still more after the Act of 1909, that 'town planning' really came to the fore. Port-Sunlight was started in 1887, and Bournville developed from 1894 onwards. In 1903 the first 'garden city' was started at Letchworth, and in 1904 the Hampstead Garden Suburb was established. The Act of 1909 gave further encouragement to this movement. See *Garden Cities*; *Industrial Villages.*

One consequence of the European War was that the housing problem was much accentuated, for building stopped almost entirely for five years, with a resultant deficiency, estimated at 500,000 houses for Great Britain, with which private enterprise was unable to cope. Accordingly the State stepped in, and an Act was passed in July, 1919, which placed on local authorities an obligation to see that provision was made for the whole working-class needs of their district, their liability being limited to the produce of a penny rate, any additional deficit to be met by the State. A minimum standard of accommodation had to be provided. Model plans of houses were issued by the Ministry of Health as a guide to local authorities and architects to the type of accommodation and general arrangement to be adopted. Architects were encouraged to suggest alternative types of plans, especially those which could be adopted at economical prices, and the more promising of these were embodied later on in a booklet of model plans issued in 1920.

Model specifications for houses, streets, by-roads, &c., were also prepared, but variations suitable to local needs were permitted. The number of houses to the acre was in the first instance limited to twelve, but in some cases up to twenty houses per acre were sanctioned. Local authorities were required to prepare housing schemes and submit them for approval to the Ministry of Health. The Government passed legislation to secure that the necessary land should be acquired on the most economical basis.

Progress was, however, slow. Local authorities hesitated to proceed with building owing to the excessive cost involved. The price of each house was abnormally high for many reasons. Building materials had risen greatly in price and continued to rise. Although bricks were being made in increasing quantities, there was serious shortage of railway trucks to move them to the districts in which they were needed. Labour was scarce, owing to the depletion of the numbers in the building trade by 200,000 as a result of the European War, and consequently wages were high. Output per man was also considerably below the pre-war level. Contractors who submitted tenders for houses inserted a clause safeguarding themselves against possible increases in their costs, and consequently local authorities were uncertain as to the extent of their commitments if tenders were accepted. Moreover, contractors were only willing to undertake house-building at a very high figure, because they had plenty of other work—extensions to factories, repairs to existing buildings, &c., offered to them at exceptionally profitable rates.

Again, the cost of houses was high, because the new type of house was of a high standard, and domestic conveniences not found in pre-war houses had to be provided.

Finally, there was the difficulty of finance. While a few local authorities were able to raise the money without much effort, this was not generally the case. Any local authority where the rateable value of the district was over £200,000 was expected to finance its own schemes, but if the rateable value were below that amount, assistance was provided out of the Local Loans Fund.

By the end of 1919 the actual number of houses started was negligible, and the Government had to offer further inducements. Before the European War 95 per cent of working-class dwellings were built by private enterprise, which stopped during the war, and did not resume after it owing to the high cost of production, which would have necessitated the charging of rents far above what people were prepared to pay in view of the general restriction of rents on existing property. In order to encourage resumption of private building the Government offered a subsidy of £150 on the average to anyone who built a house of an approved type within twelve months. (The period was subsequently extended, and the amount of the subsidy increased to £260 for a five-roomed house.) Powers were also given to local authorities to prevent 'luxury' building, and an agreement was made with employers in the building trade that a certain proportion of work undertaken by them should be on housing schemes.

Still little advance was made. Prices continued to rise, and output of labour showed little improvement. In order to remedy the shortage of labour, steps were taken to introduce 'dilutees' into the building trade. To this the trade unions were strongly opposed. They were not prepared to admit unskilled men with a few months' training to work alongside trade unionists, and a strike was threatened if the Government or employers tried to enforce dilution. All attempts at negotiation failed, and finally the Government agreed with the employers to enforce the introduction of 50,000 ex-service men into the ranks of building-trade labour. On the labour side of the problem interesting experiments were also made in the form of the employment of labour direct by local authorities, who endeavoured to dispense with the services of contractors; and the organization of the Building Guild, which was started in Manchester, and whose object was to enable groups of building-trades workers to contract with local authorities direct for the building of houses, the saving which it was hoped would be made by the elimination of the contractors' profits to be devoted partly to reducing cost and partly to improving conditions of employment. Neither the introduction of 'dilutees' nor the experiments referred to had any marked results.

In July, 1921, the situation was much affected by the increased complaints from tax-paying classes against the pressure of taxation, and also by the change in the movement of prices from upward to downward. It became necessary for the State to reduce its commitments as far as possible, and it was also obvious that with prices and wages falling, the former rapidly, it would be wise to wait till a new and lower level of cost had been reached. The number of houses provided for amounted to 176,000 under schemes of local authorities or approved societies, and about 23,000 under the subsidy to private builders, and it was decided to call a halt at this point, the State confining itself for the future to the provision of an annual contribution not exceeding £200,000 towards the deficiency on local authorities' accounts for the improvement of slum areas.

As housing accommodation was so difficult to obtain, it was suggested several times that powers should be given to local authorities to hire compulsorily dwelling-houses which had been empty for three months or more. A clause was inserted in the 1920 and 1921 Bills to give these powers, but it was dropped.

Housman, Laurence, British novelist, poet, and artist, born 18th July, 1865. He studied art at South Kensington, and began his career as an illustrator. He illustrated George Meredith's poem *Jump-to-Glory Jane*, Shelley's *The Sensitive Plant*, and Christina Rossetti's *Goblin Market*. As a poet Housman is a mystic, and the influence of Rossetti is clearly noticeable in his poems. Housman also wrote symbolical and allegorical tales, novels, and plays. His works include: *A Farm in Fairyland* (1894); *Gods and their Makers* (1897); *An Englishwoman's Love-Letters* (1900), which, published anonymously, met with very great success; *Bethlehem* (1902); *Prunella* (1906); *Lysistrata* (1910); *The Royal Runaway* (1914); *The Sheepfold* (1918); *Ploughshare and Pruning-hook* (1919).

Houssa, or **Hausa** (hous′sa), a people of Africa, in the Sudan, between lat. 11° and 14° N., and long. 4° and 11° E. They are negroes with much admixture of other races, such as Tuaregs, Berbers, &c. The country of the Houssas, or the Houssa States, is included in Northern Nigeria, is generally fertile, and skilfully cultivated. It was brought under the rule of the Fellatahs, who subjected the natives, the Hausana or Houssas. They are intelligent and lively, expert weavers as well as agriculturists, and well acquainted with tanning and working in iron. Their language is rich and sonorous, and has become the general medium of commercial intercourse in Central Africa. They are Mahommedans. The country contains Gando and other large towns.—BIBLIOGRAPHY: C. H. Robinson, *Hausaland: Fifteen Hundred Miles through the Central Soudan*; *Hausa Dictionary.*

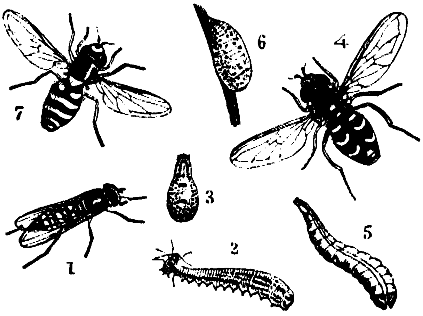
Houston, a town of the United States, in Texas, capital of Harris county, at the head of steamboat navigation on Buffalo Bay, 48 miles north-west of the important seaport of Galveston, and the great railway centre of the state. It stands in an excellent grazing district, and contains iron-foundries, cotton-presses, machine-shops, and other industrial establishments. It is a great shipping port for cotton. Pop. (1920), 138,276.

Hovas, one of the elements (more correctly the Antimerina) of the population of Madagascar, characterized by a strong infusion of Malay blood.

Hove, a watering-place of Sussex, England, practically joined to Brighton. It has all the attractions of a first-class holiday resort, and is extremely popular. Pop. 46,519.

Hoveden, Roger de, an English historian, who probably received his name from Hoveden or Howden, in Yorkshire. The exact dates of his birth and death are unknown, but he flourished in the reign of Henry II, and, entering the Church, was for some time professor of theology at Oxford. After the death of Henry he applied himself to compiling in Latin a general history of England entitled *Chronica*, commencing at 731, the period at which Bede finished, and bringing down affairs to 1201. An English translation by H. T. Riley has been published in Bohn's *Antiquarian Library.*

Hover-fly, a member of the family of the Syrphidæ, popularly known as hoverers, hawkflies, and drone-flies.



Hover-flies

1, *Syrphidæ balteatus* (slightly magnified). Larva sucking a plant-louse. 3, Pupa. 4, *Catabomba pyrastri.* 5, Larva. 6, Pupa. 7, *Syrphidæ ribesii.*

How′ard, the patrician house that has been for centuries at the head of the English nobility. The first of the family of whom anything is certainly known is Sir William Howard, Chief Justice of the Common Pleas under Edward I and Edward II. His grandson, Sir John Howard, possessed extensive property in Norfolk, and was also sheriff of the county. His grandson, Sir Robert Howard, by marrying the co-heiress of the Mowbrays, Dukes of Norfolk, greatly increased the family possessions, and enhanced the family importance. Their only son, Sir John Howard, distinguished himself in the wars with France in 1452–3, and in 1470 was created Lord

Howard, and made Captain-General of the Royal Forces at Sea. Adhering to the fortunes of Richard III, he was in 1483 created Duke of Norfolk, and elevated to the high dignity of Earl-Marshal of England, but two years after he was killed at Bosworth Field, and his blood and honours were attainted by Parliament, 1485. A like attainder was decreed against his son Thomas, who had been created Earl of Surrey by Richard. Thomas, however, was restored to his titles and possessions, manifested high military talent, and distinguished himself, especially by his defeat of James IV of Scotland at Flodden in 1513. His son Thomas, third Duke of Norfolk, obtained distinction both as a naval and military commander, and became High-Admiral of England. But in spite of his services both at home and against the Scots and the French, Henry VIII at last condemned him, on slight grounds, to suffer the death of a traitor. The death of Henry prevented the execution, and he was reinstated in his rank and property by Queen Mary, and died in Aug., 1554. By his marriage with a daughter of Edward IV he became the father of the ill-fated and accomplished Henry Howard, Earl of Surrey, the best English poet of his age. (See *Surrey, Earl of.*) Thomas, fourth Duke of Norfolk, entertained the project of marrying Mary Queen of Scots, which led to him being convicted of high treason, and beheaded in 1572. The attainder was reversed and the family honours restored, partly by James I and partly by Charles II. The ducal House of Norfolk has thrown out many branches which have enjoyed, or still enjoy, the earldoms of Carlisle, Suffolk, Berkshire, Northampton, Arundel, Wicklow, Norwich, and Effingham, and the baronies of Bindon, Howard de Walden, Howard of Castle Rising, and Howard of Glossop. As connected with this noble family we may mention Lord Howard of Effingham, who defeated the Spanish Armada in 1588; Catherine Howard, one of the ill-fated consorts of Henry VIII; and Sir Thomas Howard, who died in the Tower a prisoner, for having aspired to the hand of the Lady Margaret Douglas, daughter of Margaret, Queen-Dowager of Scotland, and niece of Henry VIII. "The blood of the Howards" has become proverbial, as expressive of ancient lineage combined with high rank.—Cf. Brenan and Statham, *The House of Howard.*

Howard, John, English philanthropist, was born in 1726, and died in 1790. His father, a wealthy London tradesman, died when his son was about nineteen years of age, and left him an immense fortune. In 1756 Howard undertook a voyage to Lisbon to view the effects of the recent earthquake. The vessel in which he embarked being captured, he was consigned to a French prison. The hardships he suffered and witnessed previous to his release first roused his attention to the subject of his future researches. In 1773 he resolved to devote his time to the investigation of the means of correcting the existing abuses in the management of prisons. With this view he visited most of the English county jails and houses of correction, and in March, 1774, he laid the result of his inquiries before the House of Commons, for which he received a vote of thanks. In 1775 and 1776 he visited many of the Continental prisons, as well as those of Scotland and Ireland; and the substance of his investigations appeared in a work he published in 1777 (*State of the Prisons in England and Wales, with an Account of Some Foreign Prisons*). This work was supplemented by his experiences of foreign prisons (1778–83). In 1789 he published an *Account of the Principal Lazarettos in Europe*, with notes on Continental and British prisons and hospitals. In the same year he made a final journey through Germany and Russia, when prisons and hospitals were everywhere thrown open for his inspection as a friendly monitor and public benefactor. He died of fever at Kherson in South Russia.

Howdenshire, one of the three parliamentary divisions of the East Riding of Yorkshire.

Howe, Elias, an American inventor, was born in Spencer, Massachusetts, in 1819, died at Brooklyn in 1867. He constructed a sewing-machine in 1846, and was for several years involved in expensive and harassing lawsuits to establish his right to reap the benefits of his own ingenuity. He received the gold medal and the cross of the Legion of Honour at the Paris Exhibition of 1867.

Howe, Richard, Earl Howe, English admiral, was the second son of Emmanuel Scrope, second Viscount Howe, and was born in 1725, died 1799. He joined the navy at the age of fourteen, and served under Anson till 1745, when, though only twenty years of age, he obtained the command of the *Baltimore* sloop of war, in which he took part in the siege of Fort William, during the last Jacobite rebellion. In 1758 he reduced Cherbourg, and in the same year succeeded to the title of Viscount Howe. Having greatly distinguished himself on many occasions, and risen to be Vice-Admiral of the Blue, he was in 1782 created an earl. In the course of the same year he sailed to the relief of Gibraltar, which he effected in spite of the combined fleets of the enemy. In 1783 he accepted the post of First Lord of the Admiralty, which, with a partial intermission, he continued to hold until 1793, when, on the breaking out of the war with France, he took the command of the British fleet, and bringing the enemy to an action on 1st June, 1794, he obtained over them a decisive victory, for which he received the thanks of Parliament and other honours. In 1797 Lord Howe exerted himself with great success to quell the mutiny among the seamen at Portsmouth.—Cf. Sir J. K. Laughton, *From Howard to Nelson—Twelve Sailors.*

Howells, William Dean, an American novelist, born at Martinsville, Ohio, in 1837, died 11th May, 1920. He learned the printer's trade with his father; was afterwards assistant editor on the *Ohio State Journal*; published a life of Abraham Lincoln and a volume of poems; and was appointed in 1861 United States Consul at Venice. On his return to America in 1865 he joined the staff of the *Nation*, became afterwards editor of the *Atlantic Monthly* (1871–81), but made himself known chiefly as a writer of novels. Amongst his works are: *Venetian Life* (1866); *Italian Journeys* (1867); *A Chance Acquaintance* (1873); *A Foregone Conclusion* (1874); *The Lady of the Aroostook* (1879); *Dr. Breen's Practice* (1883); *A Modern Instance* (1883); *The Rise of Silas Lapham* (1885); *Indian Summer* (1886); *The World of Chance* (1893); *The Landlord of the Lion's Head* (1897); *Their Silver Wedding Journey* (1899); *Heroines of Fiction* (1908); *My Mark Twain: Reminiscences and Criticisms* (1910); *The Vocation of the Kelwyns* (1920).

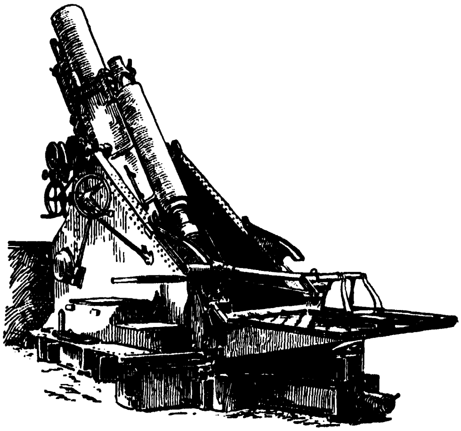
Howitt, Mary, English writer, born 1799, died in 1888. She was the daughter of Mr. Botham, a Quaker, and was married in 1823 to William Howitt. Mary Howitt wrote a number of hymns and ballads, several volumes in prose and verse for children, and translated Miss Bremer's works and H. C. Andersen's *Improvisatore*. Amongst her writings for the young may be mentioned *The Children's Year, The Dial of Love*, and *A Treasury of Tales for the Young*. In conjunction with her husband she also wrote *The Literature and Romance of Northern Europe*, and *Ruined Abbeys of Great Britain*. Six years before her death she joined the Roman Catholic Church. In 1879 she received a Civil List pension of £100.

Howitt, William, born in 1792 of a Quaker family, died in 1879. He began early to publish verses, and in conjunction with his wife (see above article) published shortly after their marriage a volume of poems—*The Forest Minstrel* (1823). In 1831 appeared his *Book of the Seasons*, in 1834 his *History of Priestcraft*, and in 1838 his popular *Rural Life in England*. In 1840 the Howitts settled at Heidelberg, and devoted themselves to introducing the literature of the north, especially of Sweden, to English readers. *Student Life in Germany* appeared in 1841, *Rural and Domestic Life in Germany* in 1842. In 1847 Howitt published his *Homes and Haunts of the British Poets*, and, after a visit to Australia, his *Land, Labour, and Gold*; and *The History of Discovery in Australia*. He also wrote a *History of England*. Afterwards both Howitt and his wife became converts to spiritualism.

Howitzers are artillery weapons of comparatively low muzzle velocity, but with a high trajectory. To obtain this high trajectory at all ranges it is necessary to have varying charges. These charges are small compared with those of guns; howitzers are therefore short-barrelled weapons with great shell power compared to guns of similar weight. Their range is less than that of guns of similar calibre.

The steep angles of departure and descent make them especially suitable for employment in close or mountainous country, and to engage targets that are in ground 'dead' to guns with a flat trajectory.

Their great shell power renders them specially adapted for the destruction of strong points—batteries, entrenchments, fortifications, &c.



Howitzer

B.L. 9·2-inch howitzer in firing position.

Owing to the low velocity of their shell, shrapnel cannot be fired effectively from howitzers, but high-explosive shell with instantaneous fuse makes them effective weapons against troops in the open.

Howitzers are generally classed as follows: (1) Pack howitzers carried on mules, ponies, &c., are invaluable in mountainous or enclosed country, or for the close support of infantry. (2) Field-howitzers form the bulk of the howitzers with a field-army. (3) Medium howitzers for the destruction of stronger works, and for counter-battery work. (4) Heavy and super-heavy howitzers for the destruction of strong defences, fortifications, &c. The Germans used a 17-inch howitzer to reduce the fortresses of Namur and Maubeuge.

Field-howitzers are at present horse-drawn, though horses are likely to be replaced in the future by some form of light mechanical tractor. Medium howitzers are sometimes horse-drawn and sometimes mechanically drawn. Heavy and super-heavy howitzers are all drawn by some form of mechanical transport, or are mounted on railway mountings.

Howler Monkey (Mycētes), a genus including six species of Central and South American monkeys, characterized by a remarkable loudness of voice, which is due to the presence of a large chamber within the hyoid bone and the enlargement of the ventricles of the larynx. In the tropical forests of America their hideous howls (probably meant to alarm their enemies) may be heard during the night more than a mile away. They are prehensile-tailed, large, and heavy of body, with a high pyramidal head flattened on the summit.

Red Howler Monkey (*Mycētes seniculus*)

Howrah, a town of India, on the right bank of the Hugli, opposite Calcutta, of which it is practically a suburb, and with which it communicates by a floating bridge. It has large dockyards, jute and sawmills, and various manufactories. Pop. 179,000.

Hoy, an island of the Orkneys, Scotland, separated from the mainland of Scotland by the Pentland Firth, and from the largest island of the Orkneys, known as Mainland, by the Sound of Hoy. It is about 13 miles long and 6 miles broad; mountainous and heathy, but with fertile tracts. It has an excellent harbour, Long-Hope. At the south-west of the island there is a detached pillar of rock 450 feet high, known as the Old Man of Hoy. Pop. 336.

Hoylake, an English watering-place in Cheshire, at the entrance of the Dee estuary, with one of the championship golf-courses, race-course, and various attractions for visitors. Pop. (urban district), 14,029.

Huber, François, a Swiss naturalist, born in 1750, died in 1831. Notwithstanding the loss of his eyesight, he was able, by the help of his wife and his reader and amanuensis, to make observations and deductions which constitute decidedly the most important contribution by any one man to our knowledge of bees. His first work was published in 1792 under the title of *Lettres à Ch. Bonnet.* Four years after his *Nouvelles Observations sur les Abeilles,* practically a new edition, enlarged and amended, of the other, appeared. His son Pierre also assisted his father, and himself published important observations on ants.

Hubert, St., the Apostle of Ardennes, a saint of the Roman Catholic Church, the patron of huntsmen, and the healer of hydrophobia. He was of a noble family of Aquitaine. While hunting in the forests of Ardennes he had a vision of a stag with a shining crucifix between its antlers, and heard a warning voice. He was converted, entered the Church, and eventually became Bishop of Maestricht and Liége. He worked many miracles, and is said to have died in A.D. 727 or 730.

Hubertusburg, formerly a hunting seat of the Electors of Saxony, in the Leipzig district, now enlarged and divided into portions, used respectively as a public prison, a hospital, a lunatic asylum, &c. Here the Peace of Hubertusburg, ending the Seven Years' War, was signed on 15th Feb., 1763.

Huc (ük), Evariste Régis, French missionary and traveller, born in 1813, died in Paris 1860. After studying theology, about 1837 he entered the order of the Lazarist Fathers, was ordained priest in 1838, in 1839 went to China as a missionary, and in company with Père Gabet made a journey of exploration in the interior of the empire and of Tibet. After this he returned in broken health to France, where he published *Souvenirs d'un Voyage dans la Tartarie, le Thibet, et la Chine pendant les Années 1844, 1845, et 1846*; *L'Empire Chinois* (1857); and *Le Christianisme en Chine* (1857).

Hucknall, formerly **Hucknall Torkard**, a town of England, Nottingham, 6 miles north by west of Nottingham, with a church, restored in 1873, in which Lord Byron is buried. Coal-mining and other industries are carried on. Pop. (urban district), 15,870.

Huddersfield, a manufacturing town, in the West Riding of Yorkshire, England, 16½ miles south-west of Leeds. The plan of the town is very regular, and the houses are well though somewhat uniformly built. Amongst its institutions are two colleges for higher education and a technical school. The town is the chief centre of the fancy woollen trade. Broadcloths, doeskins, and trouserings are also manufactured, and there are manufactories of steam-engines and machinery. It sends a member to Parliament. Pop. 110,120.

Hudson, Henry, English navigator, date of birth unknown. He sailed from London in the year 1607 in a small vessel, with only ten men and a boy, to discover the North-East Passage, and proceeded beyond the 80th degree of latitude. In a second voyage he landed at Novaya Zemlya, but could get no farther eastward. In 1609 he sailed for North America, and discovered the Hudson River, which he ascended about 50 leagues. In 1610 he sailed in an English ship named the *Discovery*, and discovered Hudson Strait and Hudson Bay, where he wintered; but his crew, after suffering many hardships, mutinied and set him adrift in a boat along with his son John and seven of the most infirm of the crew, none of whom were ever again heard of. Hudson published *Divers Voyages and Northern Discoveries* (1607), and a *Second Voyage* (1608).—Cf. Edgar M. Bacon, *Henry Hudson: his Times and his Voyages.*

Hudson, a town and port, United States, in the state of and 116 miles north of New York, on the left bank of the Hudson. It has large iron-smelting works, foundries, and breweries. Pop. 12,200.

Hudson Bay, or Hudson's Bay, an extensive bay, or rather an inland sea, Dominion of Canada, extending between lat. 51° and 64° N., and long. 77° and 95° W.; length, north to south, about 800 miles; greatest breadth, about 600 miles. Hudson Bay is navigable for four and a half months in summer (from middle of June to end of October), being obstructed by drift-ice during the rest of the year. There are many islands, reefs, and sand-banks. The shores on the east are high and bold; but those on the west, especially towards the south, are low and level, and much of the land there is favourable for stock and dairy farming. The white whale is found in its waters, and there is a considerable summer fishery.

Hudson River, a river in the United States. It rises, by two branches, in the northern part of the state of New York, in the Adirondack Mountains, about lat. 44° N. Two small streams unite to form the river, which is afterwards joined by the Schroon and Sacondaga. At Glen's Falls it has a fall of 50 feet, after which it runs almost due south to its mouth in New York Bay. Its whole course is over 300 miles; it is navigable as far as Hudson, 118 miles, for the largest vessels. The banks of the Upper Hudson are high and rocky, and the scenery very picturesque.

Hudson's Bay Company, an English trading company, chartered 2nd May, 1670. It had long a monopoly of the trade throughout the whole territory of North America whose streams flow into Hudson Bay, and at one time as far westward as the Pacific, with rights of governing and making war. In 1870 its authority was transferred by Act of Parliament to the Crown, and its territories incorporated in the Dominion of Canada, but it received a money indemnity and valuable tracts of land, which have yielded it a large revenue. Its trade in furs is still very large. During the European War the company lost over one hundred steamers, which were sunk by German submarines. See *Fur and Fur Trade.*

Hué, the capital city of Annam, on the River Hué, walled, fortified, and garrisoned by French troops who occupy the Mang-Ca or citadel. (See *Annam.*) The circumference of the walls is upwards of 5 miles. The city has a considerable trade, and since 1906 a railway connects it with Hanoi. Pop. (1922), 60,620.

Hue and Cry, in English law, the pursuit of a felon or offender, with loud outcries or clamour to give an alarm. This procedure may be taken by a person robbed, or otherwise injured, to pursue and get possession of the culprit's person, or by an officer of justice. At common law, a private person who has been robbed, or who knows that a felony is committed, is bound to raise hue and cry. This is generally done by informing the nearest constable; and this process is still recognized by the law of England as a means of arresting felons and breaking open doors without the warrant of a justice of the peace. The same name is also applied to an official paper circulated to announce the perpetration of offences.

Huelva (ṳ-el′vȧ), a seaport town of South-Western Spain, capital of the province of same name in Andalusia. It has wide and well-built streets. There are manufactures of matting, ropes, sails, &c.; a large trade in the exportation of copper ore, also in fruits and wine. The fisheries, mainly sardine and tunny, are productive. Pop. (1918), 37,753.—The province of Huelva is mountainous and well wooded in the north, and contains celebrated copper-mines (Tharsis, Rio Tinto). In the south it is comparatively level, and has a rich alluvial soil. Pop. 346,724.

Huerta, Victoriano, Mexican soldier and Provisional President of Mexico, born in 1854, died 10th Jan., 1916. He entered the army as a boy, and eventually attained the rank of brigadier-general (1902), after suppressing an Indian revolt in Yucatan. He came into prominence in 1911, served under President Porfirio Diaz, and after the latter's resignation he entered the service of Madero, but in Feb., 1913, he suddenly deserted the President and combined with General Felix Diaz to make Madero a prisoner. After Madero's murder (23rd Feb., 1913), Huerta was himself elected Provisional

President. Popular feeling, however, being against him, he resigned in 1914 and went into exile, where he died.

Huesca (ụ-es′kȧ; ancient **Osca**), a town of Spain, capital of the province of Huesca, on the Isuela. It is beautifully situated on an eminence in a fertile plain, has well-paved streets, a magnificent Gothic cathedral dating from the thirteenth century, an ancient royal palace, and a celebrated bull-ring. Pop. 12,000.—The province of Huesca is rugged and mountainous in the north, but has much fertile and comparatively level land in the south. Pop. 244,863.

Huet (ů-ā), Pierre Daniel, a French critic and classical scholar, was born at Caen, Normandy, in 1630, died in 1721. He was educated at the Jesuits' College of Caen; afterwards went to Paris; accompanied Bochart to the court of Queen Christina of Sweden; was appointed in 1670 sub-preceptor under Bossuet to the dauphin, and superintended the celebrated 'Delphin Series' (*in usum Delphini*) of the Latin classics. After the completion of his tutorship, having taken holy orders, he was made Abbot of Aulnai, and subsequently nominated Bishop of Soissons, which see he exchanged for that of Avranches, but afterwards retired to an establishment of the Jesuits at Paris, where he died. Amongst his writings are: *Carmina Latina et Græca*; *De Interpretatione*, a treatise on translation; *Sur l'origine des Romains*; *Censura Philosophiæ Cartesianæ*; and *Histoire du commerce et de la navigation des anciens*.

Hügel, Friedrich, Baron, Austro-English author, born at Florence, May, 1852. Educated at Florence and Brussels, he became deaf in 1871, as a result of typhus fever, and was unable to do any sustained mental work for some time. He settled in England in 1871, and afterwards devoted his life to the study of Biblical criticism, and to philosophy and psychology as applied to religious experience. After the death of Lord Acton, von Hügel became the foremost representative of Catholic scholarship in Great Britain. He wrote: *The Papal Commission and the Pentateuch* (with Professor Charles Briggs, 1906); *The Mystical Element of Religion* (1908–9); *Eternal Life* (1912–3); *The German Soul* (1916); besides contributing numerous articles on philosophy of religion to English, American, French, and Italian reviews. He died in 1925.

Huggins, Sir William, English astronomer, born 1824, died 1910. Educated at City of London School and privately, he early devoted himself to scientific pursuits, especially astronomy, and erected an observatory at Tulse Hill, a few miles south of London. Much of his work was connected with the spectroscope in its applications to astronomy, and especially as a means of determining the physico-chemical nature of the stars, comets, nebulæ, &c., and of ascertaining and measuring their motions. He was also highly successful in applying photography to the study of the stars and their spectra. Elected a Fellow of the Royal Society in 1865, he was president of the society from 1900 to 1905, and had other honours conferred upon him, being created K.C.B. in 1897.

Hughenden (hū′en-den), or **Hitchendon**, a parish and village of England, in Buckinghamshire, a short distance north of High Wycombe, with a church containing the tomb of the Earl of Beaconsfield, and a statue of him erected by Queen Victoria. Pop. 1730.

Hughes, David Edward, inventor of the printing telegraph and other electrical instruments, born in London in 1831, died in 1900. He spent his early life in America, and there, in 1855, patented his printing telegraph, which was at once adopted in the United States, some years later in France, which he visited in order to secure its adoption, and by 1876 practically in every European country. Other inventions of his were the microphone and the induction balance. He left a large fortune, which he bequeathed chiefly to four London hospitals.

Hughes, Thomas, an English barrister, author, and philanthropist, born at Uffington, Berkshire, in 1822, died in 1896. He was educated at Rugby under Dr. Arnold, and afterwards at Oxford. In 1848 he was called to the Bar, and in 1869 became a Queen's Counsel. He is widely known by his story *Tom Brown's School-days*, a picture of school life at Rugby, published in 1856. It was followed by *Tom Brown at Oxford* (1861), *A Layman's Faith* (1868), *Alfred the Great* (1869), *The Manliness of Christ*, and other writings. He was one who devoted much time to the social elevation of the working-class, encouraging in particular the co-operative system. From 1865 to 1868 he was member of Parliament for Lambeth, and from 1868 to 1874 for Frome. He was afterwards a county-court judge.

Hughes, Rt. Hon. William Morris, Australian statesman, born in Wales 25th Sept., 1864. Educated at Llandudno Grammar School, he went to Australia in 1884, was employed as a sheep-drover for some time, and in 1890 settled in Sydney. Here he organized the wharf labourers during a strike, and became secretary of their Union. Entering politics as a member of the Legislative Assembly of New South Wales in 1894, he resigned his position in 1901 on becoming member of the Federal Government. He was Minister for External Affairs, and Attorney-General in various Labour administrations from 1908–15, when he succeeded Andrew Fisher as Prime Minister. He broke with the extreme section of the Labour party when he was defeated on the subject of conscription, and formed a coalition with the Liberals. In 1918 he represented the Commonwealth at the Imperial War Cabinet, and attended the Peace Conference in Paris in 1919. He was made a Privy Councillor in 1916.

Hugli, or **Hooghly** (hōg'li), a river of Hindustan, in Bengal, one of the Ganges mouths, formed by the Bhagirathi and the Jalangi, about 55 miles above Calcutta. It is 15 miles wide at its mouth, but much encumbered by shoals. At Calcutta it is about a mile wide, and has rapid and violent tides. The south-west monsoons produce a 'bore' in the Hugli, that is, a tidal wave which rushes up the river at the rate of 15 or 20 miles an hour. Ships drawing 26 feet ascend as far as Calcutta. Total course, about 200 miles.

Hugli, a town of Hindustan, in Bengal, on the Hugli River, 22 miles north of Calcutta. It was founded by the Portuguese in 1537. It was made the seat of a British factory in 1676, but declined in importance as Calcutta rose. An important iron railway bridge connecting the East India railway system with that of the Eastern and Northern Bengal railway crosses the river near the town. Pop. 29,383.

Hugo (ü-gō), Victor Marie, a French poet and novelist, born 26th Feb., 1802, at Besançon, where his father, then Major Hugo, was stationed in command of a brigade, died 2nd May, 1885. His father having entered the service of Joseph Bonaparte, King of Italy, and afterwards of Spain, Victor's earlier years were partly spent in those countries, but in 1812 he went with his mother to Paris. At the age of twelve he was already writing verses, and in 1823 his first novel, *Han d'Islande*, appeared, followed in 1825 by *Bug Jargal*. In 1828 a complete edition of his *Odes et Ballades* appeared. In all these writings Hugo's anti-classical tendencies in style and treatment of his subject had been very visible, but the appearance of his drama *Cromwell* (1827), with its celebrated preface, gave the watchword to the anti-Classical or Romantic school. *Cromwell* was too long for representation, and it was only in 1830 that *Hernani*, over which the great contest between Classicists and Romanticists took place, was brought on the stage. Other dramas followed—*Marion Delorme* (1831), *Le Roi s'amuse* (1832), *Lucrèce Borgia* (1833), *Marie Tudor* (1833), *Angelo* (1835), *Ruy Blas* (1838), *Les Burgraves* (1843). During those years he had also published a novel of the fifteenth century, *Notre Dame de Paris* (1830), and several volumes of poetry, *Les Orientales* (1829), *Les Feuilles d'Automne* (1831), *Les Chants du Crépuscule* (1835), *Les Voix intérieures* (1837), *Les Rayons et les Ombres* (1840). The poetry of this period has a melody and grace superior perhaps to any that he afterwards wrote, but wants that deep and original sense of life which is characteristic of his later poems. During the same period he also wrote his critical essays on Mirabeau and Voltaire, and a number of articles for the *Revue de Paris*. In 1841, after having been twice previously rejected, he was elected a member of the French Academy; shortly afterwards he made a tour in the Rhineland, of which he wrote a brilliant and interesting account in *Le Rhin*, published in 1842. In 1845 he was made a peer of France by Louis Philippe. The revolution of 1848 threw Hugo into the thick of the political struggle. At first his votes were decidedly Conservative, but afterwards, whether from suspicion of Napoleon's designs or from other reasons, he became one of the chiefs of the Democratic party. After the *coup d'état*, 2nd Dec., 1851, he was one of those who kept up the struggle in the streets against Napoleon to the last. He then fled to Brussels, where he published the first of his bitter satires on the founder of the Second Empire, *Napoléon le Petit*. In the following year (1853) the second, the famous volume of *Les Châtiments*, a wonderful mixture of satirical invective, lyrical passion, and pathos, appeared. Hugo now went to live in Jersey, was expelled along with the other French exiles in 1855 by the Government of the island, and finally settled in Guernsey. It was in the comparative solitude and quietness of the Channel Islands that he wrote most of the great works of his later years, *Les Contemplations* (1856), *La Légende des Siècles* (first series 1859), *Chansons des Rues et des Bois* (1865), and his celebrated series of social novels, *Les Misérables* (1862), *Les Travailleurs de la Mer* (1866), and *L'Homme qui rit* (1869). In 1870, after the fall of the Empire, Victor Hugo returned to Paris, where he spent the remaining years of a remarkably vigorous old age in occasional attendances at the Senate, and in adding to the already long list of his literary works. Amongst these latest productions we may mention: *L'Année terrible* (poems on the war, 1872), *Quatrevingt-treize* (1872), *L'Art d'être grand-père* (1877), *L'Histoire d'un Crime* (1877), *Le Pape* (1878), *Les Quatre Vents de l'Esprit* (1881), *La Légende des Siècles* (last series 1883), and *Torquemada* (1882). A complete edition of his works was published in 58 volumes between 1885 and 1902.—BIBLIOGRAPHY: Sainte-Beuve, *Portraits Contemporains*; C. Renouvier, *Victor Hugo le philosophe*; T. Legay, *Victor Hugo jugé par son siècle*; A. F. Davidson, *Victor Hugo: his Life and Work*; F. T. Marzials, *Life of Victor Hugo*; J. Claretie, *Victor Hugo: Souvenirs intimes*; Mme Duclaux, *Victor Hugo*.

Huguenots (hū'ge-nots), a term of unknown origin, applied by the Roman Catholics to the Protestants of France during the religious struggles of the sixteenth and seventeenth centuries. During the early part of the sixteenth century the doctrines of Calvin, notwithstanding the opposition of Francis I, spread widely in France. Under his successor, Henry II (1547–59), the Protestant party grew strong, and under Francis II became a political force headed by the Bourbon family, especially the King of Navarre and the Prince de Condé. At the head of the Catholic party stood the Guises, and through their influence with the weak young king a fanatical persecution of the Huguenots commenced. The result was that a Huguenot conspiracy, headed by Prince Louis de Condé, was formed for the purpose of compelling the king to dismiss the Guises and accept the Prince de Condé as regent of the realm. But the plot was betrayed, and many of the Huguenots were executed or imprisoned. In 1560 Francis died, and during the minority of the next king, Charles IX, it was the policy of the queen mother, Catherine de' Medici, to encourage the Protestants in the free exercise of their religion in order to curb the Guises. But in 1562 an attack on a Protestant meeting made by the followers of the Duc de Guise commenced a series of religious wars which desolated France almost to the end of the century. Catherine, however, began to fear that Protestantism might become a permanent power in the country, and suddenly making an alliance with the Guises, between them they projected and carried out the massacre of St. Bartholomew's (25th Aug., 1572). The Protestants fled to their fortified towns and carried on a war with varying success. On the death of Charles IX, Henry III, a feeble sovereign, found himself compelled to unite with the King of Navarre, head of the House of Bourbon and heir apparent of the French crown, against the ambitious Guises, who openly aimed at the throne, and had excited the people against him to such a degree that he was on the point of losing the crown. After the assassination of Henry III the King of Navarre was obliged to maintain a severe struggle for the vacant throne; and not until he had, by the advice of Sully, embraced the Catholic religion (1593) did he enjoy quiet possession of the kingdom as Henry IV. Five years afterwards he secured to the Huguenots their civil rights by the Edict of Nantes, which confirmed to them the free exercise of their religion, and gave them equal claims with the Catholics to all offices and dignities. They were also left in possession of the fortresses which had been ceded to them for their security. This edict afforded them the means of forming a kind of republic within the kingdom, which Richelieu, who regarded it as a serious obstacle to the growth of the royal power, resolved to crush. The war raged from 1624 to 1629, when Rochelle, after an obstinate defence, fell before the royal troops; the Huguenots had to surrender all their strongholds, although they were still allowed freedom of conscience under the ministries of Richelieu and Mazarin. But when Louis XIV and Madame de Maintenon set the fashion of devoutness, a new persecution of the Protestants commenced. They were deprived of their civil rights, and bodies of dragoons were sent into the southern provinces to compel the Protestant inhabitants to abjure their faith. The Edict of Nantes was revoked in 1685, and by this act more than 500,000 Protestant subjects were driven out to carry their industry, wealth, and skill to other countries. In the reign of Louis XV a new edict was issued repressive of Protestantism, but so many voices were raised in favour of toleration that it had to be revoked. The Revolution first put the Protestants on an equality with their Catholic neighbours.—BIBLIOGRAPHY: A. Galton, *Church and State in France*; N. A. F. Puaux, *Histoire populaire du Protestantisme français*; C. W. Baird, *History of the Huguenot Immigration to America*; R. L. Poole, *Huguenots of the Dispersion.*

Huia-bird, the native name of a genus of New Zealand starlings, *Heteralocha acutirostris* or *Neomorpha Gouldii*, comprising a single species of birds, occupying a very limited space in a few densely-wooded mountain ranges. The plumage is a very dark green, appearing to be black in some lights, the tip of the tail white. The most striking peculiarity about this bird is that the male has a stout, straight beak, used for chipping the bark from decayed trees; the female a long, slender, curved one, by which crevices in the wood are explored for insects.

Hull, a city of Canada, province of Quebec, on the left bank of the Ottawa, opposite to the city of Ottawa. It has large saw-mills, and manufactures of paper, paper pulp, wooden wares, and furniture. Pop. 18,222.

Hull, or **Kingston-on-Hull**, a river port, municipal and parliamentary borough of England, and a county of itself, which is situated in the East Riding of York at the influx of the Hull into the estuary of the Humber. The town stands on a low and level tract of ground, and stretches along the banks of the Humber, from the inundations of which it is secured by strong embankments. Amongst the notable public buildings and institutions are the town hall, the new exchange, the corn exchange, dock offices, &c., the royal institution, the public rooms, Hull and East Riding College, Reckitt Free Library, the infirmary, dispensary, children's hospital, &c. There are three well-laid-out public parks. The industries of the town are varied, comprising flax- and cotton-mills, shipbuilding, rope- and sail-works, iron-foundries, machine-making, seed-crushing, colour-making, oil-boiling, &c.; but its importance arises chiefly from its shipping commerce, Hull being one of the busiest seaports in the kingdom. It is the sixth port in the United Kingdom in respect of tonnage, being exceeded by London, Liverpool, Cardiff, Newcastle, and Southampton. The docks are amongst the largest in the kingdom. The railway communications are excellent, no fewer than five railway companies running into the town. It is an ancient town, and was of some importance long before it received its charter from Edward I. It played a conspicuous part during the Civil War, being held by the Parliamentary forces, and twice besieged without success. It has four parliamentary divisions, East, Central, North-West, and South-West, each of which returns one member. Pop. 287,013.

Hullah, John Pyke, an English musician, born in 1812, died in 1884. He entered the Royal Academy of Music in 1832, and attracted some attention by his comic opera *The Village Coquettes* (1836), which was followed by *The Barber of Bassora* in 1837, and *The Outpost* in 1838. About this time he began to work for the establishment of popular singing-schools. He wrote some educational and historical works on music, amongst which are the *Grammar of Harmony*, *Grammar of Counterpoint*, and *A History of Modern Music*.

Hulse'an Lectures, a series of discourses delivered annually at Cambridge, under a bequest by the Rev. John Hulse (1708–90). The lectures must not be fewer than four or more than six. The subject prescribed is the evidences of revealed religion, or the explanation of the most difficult texts or obscure parts of Holy Scripture. The persons eligible as lecturers are Masters of Arts of the University of Cambridge. The first Hulsean lecturer was Christopher Benson (1789 - 1868), who delivered his lectures in 1820.

Humanism and Humanists. Humanism is a term applied to the literary and intellectual movement which started at the close of the Middle Ages, in the fourteenth century, and ended in the sixteenth. Its object was the revival of classical antiquity and pagan learning. It was essentially a literary and intellectual movement, attempting to emancipate education and thought from the shackles of scholasticism. By establishing a contact with the great minds of classical antiquity, it led the way to a revival of learning and stimulated erudition, art, and literature. It also accentuated the meaning and worth of mundane life and of human nature, and strenuously opposed mediæval thought and dogmatic teaching. The word humanism is derived from *humanitas* in its sense of " mental culture befitting a man, or liberal education ", as used by Cicero and Aulus Gellius. It meant, therefore, the study of humane letters, of the languages and literatures of Greece and Rome, as some of the humanists maintained that the study of Greek and Roman classics was the only way to gain humane culture. The humanists were the scholars and poets who endeavoured to revive, not only the literature of ancient Hellas and Rome, but also the pagan spirit of the cults of antiquity. They were all great lovers of learning, admirers of beauty of form and of thought, partisans of a broader outlook upon life, and of a humanity of spirit, rebels, therefore, against the dogmatism of the Middle Ages and their cramping tenets and laws. From beneath the lumber accumulated during the Dark Ages they disinterred and brought forth the treasures of the past, and restored to Europe a new means of culture. There were already precursors of humanism in the thirteenth century, but it was in the fourteenth century that the movement began in Italy. For centuries, all through the Dark Ages, man had lain dreaming or half awake under a veil woven of faith, illusion, and childish prepossession. He was conscious of himself merely as a member of a people, a race, a family, or a party. Feudalism and ecclesiasticism, Church and State, were all-powerful and had put their restrictions even upon the intellectual activities of the individual. Mediæval ecclesiasticism had cramped man's views, had imposed upon him an artificial system of thought and a supernatural conception of the universe. A new era, however, began to dawn in Italy of the fourteenth century. The states of Italy furthered civic liberty and encouraged a mundane conception of life, freedom of thought, and, above all, the claims of individuality. Under these influences man began to consider himself a spiritual being. The spirit of revolt moved its wings, and mediæval man, the slave and bondman of feudalism and of ecclesiasticism, dared to think for himself. The rays of a new dawn tinted with orient hues the sombre sky of mediævalism, and accentuated the worth and meaning of human nature, human individuality, and human personality. It has been rightly said that " the growth and development of individualism, the doctrine that man should think for himself, a mental function which had been neglected during the age of mental slavery, was one of the brightest victories of the humanists ". This growth of individualism in Italy prepared the human mind for an interest in ancient life and literature. The realization had gradually grown upon the newly awakened individual that behind him, in the past, lay a history which could teach him many things.

Weary of scholasticism, weary of the ecclesiastical chains, he turned to the freedom of antiquity, to the study of Greek thought and culture, religion, art and literature, which had all "extolled the beauty of nature and the joy of life". It was quite natural that the spirit of antiquity should be first revived in Italy, where the remains of an ancient civilization still existed, and where the spirit of paganism still lingered. Indeed, the spirit of antiquity and of paganism, never dead in Italy, but lulled to sleep by the whisperings of religious mysticism, or hypnotized by the powerful gaze of Papacy, was awakened, like an enchanted princess, by the kiss of the Italian poets.

The founder of humanism, in so far as it had an individual founder, was Petrarch (1304–74), the great lyric poet, but in Dante (1265–1321), though he is best regarded as giving final expression to the loftiest spirit of mediævalism, we see clearly the advent of the new spirit. Petrarch was an enthusiastic student of Roman antiquity, and an untiring collector of manuscripts. He perceived the importance of a knowledge of Greek, though he never really learned it himself. Boccaccio (1313–75) also had the passion for collecting which was to characterize all the early humanists, and may be regarded as the first Grecian of the modern world, since he learned the Greek language from Leontius Pilatus, a Greek resident in Florence. The real introducer of the Greek language into Italy, however, was Manuel Chrysoloras, a native of Byzantium, who began to teach at Florence in 1396. The humanists soon attained a position of the greatest importance in Italy. Their lectures were attended by immense numbers from all ranks of society, and wealthy men vied with one another in patronizing them. The Popes themselves were for a long time in the main favourably disposed to humanism, and some of them, notably Nicholas V, Pius II, and Leo X were humanists of no mean order themselves. Among other notable patrons of the humanist movement the names of Cosmo and Lorenzo de' Medici in Florence, and Alfonso, King of Naples, are pre-eminent. Florence, on the banks of the Arno, became the seat of learning, and from the Medicean gardens the new vivifying stream came forth to water the barren land of mediævalism. Forth from Italy the movement spread and passed into Germany, Spain, Holland, France, and England. Jean de Montreuil, Guillaume Budé, and Étienne Dolet in France; Reuchlin Hutten and Melanchthon in Germany; Thomas Linacre, William Grocyn, William Lily, and Sir Thomas More in England; and Erasmus of Rotterdam in Holland, are a few of the most prominent humanists.

Humanism also means the tendency to regard human life as an independent centre of interest, and to explain the rest of the universe by reference to man's life. See *Pragmatism*.—BIBLIOGRAPHY: J. A. Symonds, *The Renaissance in Italy*; J. Burckhardt, *The Civilization of the Renaissance*; A. Pearson, *A Short History of the Renaissance in Italy*; J. S. Mackenzie, *Lectures on Humanism*; Sir J. E. Sandys, *History of Classical Scholarship*.

Humanities is a term which arose in the fifteenth century, and was applied to the study of the classical literatures of Greece and Rome. It owes its origin to the word *humanitas* as used by Cicero and Aulus Gellius in the sense of culture as befitting a man as a man. The scholastics used *literæ humaniores* (more humane letters) in contradistinction to *divinitas* (or the study of divinity and theology). The humanists of the early Renaissance, on the other hand, gave to the word humanities the significance of culture and the study of the ancient classics, since, as they maintained, culture could only be gained by studying the works of Greek and Roman authors.

In the Scottish universities the term humanity, in the singular, still designates the study of the Latin language and literature, and at Oxford *literæ humaniores* is applied to classical studies. In a wider sense the term humanities is now used to include the sciences concerned with human civilization, i.e. not only philology, but also philosophy, history, and political science.

Humber, a large river (estuary), on the east of England, between the counties of York and Lincoln. At its western extremity it is joined by the Ouse, after the latter has been augmented by the Derwent and Aire; below Goole it receives the Don, lower down the Trent, and still lower the Hull from the opposite side. It is about 35 miles long, and varies in breadth from 1 to 7 miles. There is at all times a considerable depth of water in the fairway of the channel, and the navigation is safe and easy.

Humbert I, Umberto, King of Italy, born 14th March, 1844, eldest son of Victor Emmanuel II. In the war of 1866, in which Italy joined Prussia against Austria, he took the field in command of a division, and distinguished himself by his bravery in the disastrous battle of Custozza. In 1868 he married his cousin, Margherita, daughter of Duke Ferdinand of Genoa. He succeeded his father on 9th Jan., 1878, and was assassinated by an anarchist named Bresci on 29th July, 1900. Humbert was succeeded by his son Victor Emmanuel III.

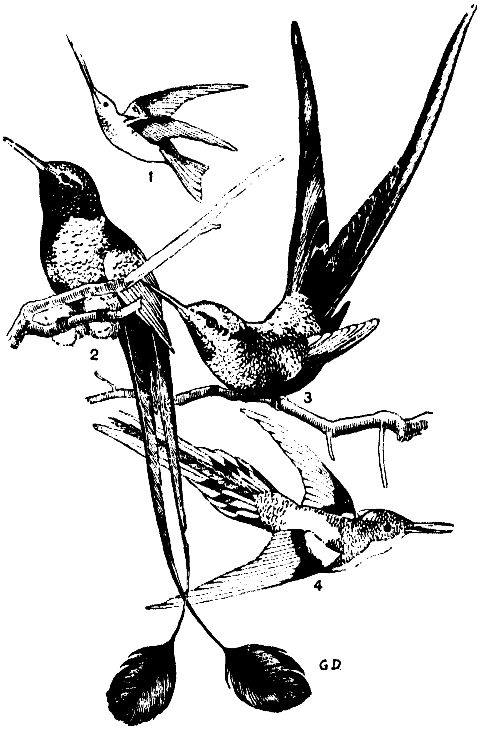
Humboldt (hụm'bolt), Friedrich Heinrich Alexander, Baron von, a German traveller and naturalist, was born 14th Sept., 1769, at Berlin, where his father held the post of royal chamberlain, and died in 1859. He studied at the Universities of Frankfort-on-the-Oder, Berlin, and Göttingen, and also at the commercial academy in Hamburg. His first work was *Observations on the Basalt of the Rhine* (1790). In 1791 he studied mining and botany at the mining school in Freiberg, and subsequently became overseer of the mines in Franconia. In 1797 he resolved to make a scientific journey in the tropical zones along with a friend, Aimé Bonpland. They landed at Cumana, in South America, in July, 1799, and spent five years in exploring scientifically the region of the Orinoco and the upper part of the Rio Negro, the district between Quito and Lima, the city of Mexico and the surrounding country, and the Island of Cuba. In 1804 they arrived at Bordeaux, bringing with them an immense mass of fresh knowledge in geography, geology, climatology, meteorology, botany, zoology, and every branch of natural science, as well as in ethnology and political statistics. Humboldt selected Paris as his residence, no other city offering so many aids to scientific study, and remained there arranging his collections and manuscripts till March, 1805. He then visited Rome and Naples in company with Gay-Lussac, but eventually returned to Paris in 1807, when the first volume of his great work, *Voyage aux régions équinoxiales du nouveau continent*, appeared; the thirtieth and last was published in 1827. In 1827 Humboldt, who had been offered several high posts by the Government of Prussia, and had accompanied the king on several journeys as part of his suite, was persuaded to give up his residence at Paris and settle at Berlin, where he combined the study of science with a certain amount of diplomatic work. In 1829, under the patronage of Tsar Nicholas I, he made an expedition to Siberia and Central Asia, which resulted in some valuable discoveries, published in his *Asie Centrale*. In 1835 he published at Paris his *Examen critique de la géographie du nouveau continent*. In 1845 appeared the first volume of the *Cosmos*, his chief work, a vast and comprehensive survey of natural phenomena, in which the idea of the unity of the forces which move below the variety of nature is thoroughly grasped.—Cf. R. H. Stoddard, *Life, Travels, and Books of Alexander Humboldt*.

Humboldt, Karl Wilhelm, Baron von, brother of the preceding, was born at Potsdam in 1767, died in 1835. He studied at Berlin, at Frankfort-on-the-Oder, and at Göttingen. After travelling in France and Spain, and acting as Prussian minister at Rome, he was called to fill the office of Minister of the Interior in connection with ecclesiastical and educational matters, and had a share in the reform of Prussian education. In 1810 he became Minister Plenipotentiary to Vienna, took an active part in the conclusion of the Peace of Paris (1814), and at the Congress of Vienna (1815), and other great diplomatic transactions. In 1819 he was an active member of the Prussian ministry, but resigned and retired to his estate at Tegel, where he died. His works include poems and literary essays, but by far the most valuable are his philological writings, such as *Additions and Corrections to Adelung's Mithridates*, *Researches regarding the Original Inhabitants of Spain in Connection with the Basque Language*, *On the Kawi Language of Java*, and *On the Diversity of Language and its Influence on the Development of Speech.*

Hume, David, an eminent historian and philosopher, was born at Edinburgh on 26th April, 1711, died 25th Aug., 1776. He was destined for the law, but was drawn away by his love of literature and philosophy, and retired to France, where during three years of quiet and studious life he composed his *Treatise upon Human Nature*. The work was published at London in 1738, but, in his own words, "fell dead-born from the press". His next work, *Essays, Moral, Political, and Literary* (Edinburgh, 1742), met with a better reception. In 1745 he became companion to the insane Marquess of Annandale; and he accompanied General St. Clair in 1746 and 1747 on his expedition against France and on a military embassy to Vienna and Turin. He now published a recasting of his *Treatise upon Human Nature*, under the title of an *Inquiry Concerning the Human Understanding* (1747). In 1752 he published his *Political Discourses*, which were well received, and his *Inquiry Concerning the Principles of Morals*. The same year he obtained the appointment of librarian of the Advocates' Library at Edinburgh, and began to write his *History of England*, of which the first volume appeared in 1754. It was, like most of the succeeding volumes, severely attacked both for its religious and political tendencies; but, in spite of adverse criticism, his *History of England*, after its completion in 1761, was recognized as a standard work. Its merits are chiefly clearness and force of narrative and philosophical breadth of view in the judgment of men and events. In 1763 he accepted an invitation from the Earl of Hertford, then proceeding as Ambassador to Paris, to accompany him, and was enthusiastically received by Parisian circles in his character of philosopher and historian. After the departure of Lord Hertford in 1756, he remained as chargé d'affaires, and returned to England in 1766, bringing with him Rousseau, for whom he procured a pension and a retreat in Derbyshire. But the morbid sensitivity of Rousseau brought about a disagreement which put an end to the friendship. In 1767 he was appointed Under-Secretary of State, a post which he held till 1769, when he retired to Edinburgh, where he lived till his death. As a philosopher, in which quality his reputation is perhaps greatest, Hume's acute sceptical intellect did great service by directing research to the precise character of the fundamental conceptions on which our knowledge and our beliefs are based. His philosophy has been regarded as a continuation and a culmination of the line of thought begun by Locke and Berkeley. Hume's philosophy, however, was more than a mere development of the ideas of Locke and Berkeley, his predecessors. His acute negative criticism of these conceptions (e.g. his reduction of the ideas of personal identity, conscience, and causality, to mere effects of association) compelled philosophy either to come to a dead halt or to find, as Kant did, a new and profounder view of the nature of human reason. —Bibliography: W. Knight, *Hume* (in Philosophical Classics); J. Hill Burton, *Life and Correspondence of David Hume*; T. H. Huxley, *Hume* (English Men of Letters Series); J. Seth, *English Philosophers and Schools of Philosophy*.

Hume, Joseph, politician and economist, born at Montrose in 1777, died in 1855. After studying medicine at Edinburgh he was appointed marine assistant-surgeon in the service of the East India Company. Having qualified himself by a diligent study of the native languages, he obtained several lucrative posts connected with the Commissariat and the Pay Office, and in 1808, when only in his thirty-first year, he was able to return to Europe with a considerable fortune. After making a tour in Southern Europe and Egypt he became in 1812 Tory member for the 'rotten borough' of Weymouth; but losing his seat in 1813, began to take an active part in regard to Lancasterian schools, savings'-banks, and other measures of social reform. In 1818 he was again returned to Parliament as member for the Aberdeen district of burghs. It was now that he began his career as an active advocate of reforms, such as the emancipation of the Catholics, the repeal of the Test and Corporation Acts, and economy in public expenditure. He had no power as an orator, his strength lying in his handling of figures and the tenacity and energy with which he carried on his crusade against corruption. After representing Middlesex and Kilkenny County he was returned by the Montrose burghs in 1842, and continued to represent them till his death.

Humming-birds, the name given to a family (Trochilidæ) of minute and beautiful birds, so called from the sound of their wings in flight. The beak is slender, generally long, sometimes straight and sometimes curved; the tongue is long, filiform, bifid at the point, and capable of being protruded to a considerable distance. In size humming-birds vary from that of a wren to that of a humble-bee. They never light to take food, but feed while on the wing, hovering before a flower, supported by a rapid vibratory movement of the wings which produces the humming noise. Insects form a great proportion of their food. These beautiful birds are peculiar to America, and mainly tropical, though they range from Alaska to Tierra del Fuego. One species, the ruby-throated humming-bird (*Trochilus colubris*), is common in the north-east of the United States and in Canada. The only note of the humming-bird is a single chirp, not louder than that of a cricket. It is very fearless and irascible, two males scarcely ever meeting without a contest. Among the more remarkable of these birds is the tufted-necked humming-bird (*Ornismya ornāta*) of Guiana and Northern Brazil. In this species the crest, outer tail-feathers, and neck-plumes are reddish chestnut, the latter tipped with green, the throat and upper part of the breast are emerald green, the back bronze green. About five hundred species of humming-birds are now known.



Humming-birds

1, Sword-billed (*Docimastes ensifer*). 2, Racket-tailed (*Steganurus underwoodi*). 3, Fork-tailed (*Thaluriana furcata*). 4, Horned or Sun-gem (*Heliactinus cornutus*).

Humus, a substance which occurs in vegetable mould, and in liquids containing decomposing vegetable matter. Humus as it exists in the soil is a product of the decay of vegetation or stable manure. It is a mixture of various carbon compounds, which slowly undergo combustion with the production of carbon dioxide, water, and ammonia, which are again taken up by plants. It is characterized by its powers for the retention of water in a soil, improvement of aeration, and it facilitates the mechanical operation of tillage.

Hundred, in England, a division of a shire or county. It was so called, according to some writers, because each hundred found 100 sureties of the king's peace, or 100 able-bodied men of war. Others think it to have been so called because originally composed of 100 families. Hundreds are said to have been first introduced into England by Alfred. Formerly if a crime was committed, such as robbery, arson, killing or maiming cattle, destroying turnpikes or works on navigable rivers, the hundred had to make it good; but hundreds are now only liable for damage done by rioters acting feloniously.

Hungary (Hungarian name, *Magyar-Ország*, Land of the Magyars), an inland state of Central Europe, one of the states formed out of the former Austro-Hungarian Empire. The old Hungarian Kingdom included until 1919 Hungary Proper with Transylvania, Slavonia, Croatia, the Croato-Slavonian Military Frontiers, &c.; total area, 125,575 sq. miles, with a pop. of 21,000,000. In 1919 Hungary was reduced to the great plain, the Alföld, and the new state is less than half the size of the old kingdom. It is bounded north by Czecho-Slovakia and Ukraine, east by Roumania, south by Yugo-Slavia, and west by Austria. The total area is 36,000 sq. miles, and the pop. 7,500,000. The Carpathians, which cover the northern and eastern parts of old Hungary, now belong to Czecho-Slovakia. The Danube and the Theiss, with their affluents, are the chief rivers. The Drave now forms the south-west frontier between Hungary and Yugo-Slavia. Between the Danube and the Drave lie the two principal lakes, the Platten See or Balaton Lake and the Neusiedler See, from which the water occasionally disappears. Hungary is one of the healthiest countries in Europe, and has a fertile soil generally. All kinds of grain, especially excellent wheat, wines, fruits, tobacco, hemp, flax, hops, saffron, woad, madder, sumach, cotton, are among the products of Hungary. Horses, cattle, sheep, hogs, game (in the north bears), poultry, fish (especially the sturgeon and salmon), bees, and silk-worms are among the productions of the animal kingdom. Among the minerals are gold, silver, copper, iron, lead, zinc, cobalt, antimony, sulphur, arsenic, salt, &c., with coals and peat. The Magyars now form almost the entire population of the new state (83 per cent). They are brave, high-spirited, and sincere, in many respects resembling their kinsmen the Turks. A decided majority are Roman Catholics, the rest Protestants, chiefly Calvinists. Science, literature, the press, trade and industry, are for the greater part in their hands. The Hungarian has a natural inclination to agriculture and the breeding of cattle, and the fertility of the soil making up for some deficiencies in methods has made Hungary one of the chief corn-growing countries of Europe. It is also celebrated for its wines, the finest variety of which is the Tokay. There are few extensive manufactures in Hungary. Iron- and steel-works, potteries, glass manufactories, sugar-refineries, soap- and tallow-works, are amongst the principal. The production of coal and iron is increasing. With regard to popular education Hungary was behind the Austrian part of the empire, but education was made compulsory in 1868. There were five universities in the former Kingdom of Hungary, the Universities of Budapest, Kolozsvar, Zagreb (Agram), Pozsony (Pressburg), and Debreczen.

History.—The Magyars, an Asiatic people of Turanian race, allied to the Finns and the Turks, dwelt in what is now Southern Russia before they descended under Arpád into the plain of the Danube, towards the end of the ninth century, and conquered the whole of Hungary and Transylvania. During the first half of the tenth century their invasions and incursions spread terror throughout Germany, France, and Italy; but at length their total defeat by Otho I of Germany put an end to their maraudings, and under their native dynasty of Arpáds they settled down to learn agriculture and the arts of peace. Stephen I (997–1030) was the first who was successful in extending Christianity generally amongst the Hungarians, and was rewarded by a crown from Pope Sylvester II and with the title of *apostolic king* (1000). Stephen encouraged learning and literature, and under him Latin became not only the official language of the Government, but the vehicle of Hungarian civilization, which it continued to be for the next 800 years. In 1089 King Ladislaus extended the boundaries of Hungary by the conquest of Croatia and Slavonia, and King Coloman by that of Dalmatia in 1102. During the twelfth century the Hungarians first attained, through French connections, a certain refinement of life and manners. About the middle of the thirteenth century King Bela induced many Germans to settle in the country, which had been depopulated by the Mongol invasions. With Andrew III (1290–1301) the male line of the Arpád dynasty became extinct, and the royal dignity now became purely elective. Charles Robert of Anjou was the first elected (1309).

Louis I (1342–82) added Poland, Red Russia, Moldavia, and a part of Serbia to his kingdom. The reign of Sigismund (1387–1437), who was elected Emperor of Germany, is interesting from the invasion of Hungary by the Turks (1391), and the war with the Hussites. Sigismund introduced various reforms, and founded an academy at Buda. Matthias Corvinus (1458–90), combining the talents of a diplomatist and general, was equally successful against his enemies at home and abroad, and is even yet remembered by the popular mind as the ideal of a just and firm ruler. He founded a university at Pressburg. During the reigns of Ladislaus II (1490–1516) and Louis II (1516–26) the rapacity of the magnates and domestic troubles brought the power of Hungary low, and the battle of Mohacs (1526) made a great part of the country a Turkish province for 160 years. The rest was left in dispute between Ferdinand of Austria and John Zapolya; but eventually, by the help of the Protestants, passed to the former, and remained under the sceptre of the Habsburgs till 1918. In 1686 Leopold I took Buda and recovered most of Hungary and Transylvania. In 1724 Charles VI secured by the Pragmatic Sanction the Hungarian crown to the female descendants of the House of Habsburg, and the loyalty of the Hungarians to his daughter, Maria Theresa, saved the dynasty from ruin. Maria Theresa did much for the improvement of Hungary by the promulgation of the rural code called Urbarium, and by the formation of village schools. On the advent of the French Revolution, and during the wars which ensued, the Hungarians once more played a prominent part in support of the Habsburg crown. Napoleon fell, but the Revolution had given an impetus to ideas of national and popular rights which the Hungarians, long stifled under the Germanic traditions and tendencies of their rulers, were amongst the first to feel. For a time Francis I and Metternich stood stiffly out against all concessions, and tried to govern by pure absolutism, but ended by summoning in 1825 a new Diet. The Diet distinguished itself by adopting the Magyar language in its debates instead of the Latin to which it had been accustomed. Succeeding Diets in 1830 and 1832 made new demands in the direction of religious equality, a popular suffrage, and abrogation of the privileges of the nobles. The Austrian Government attempted to repress the Hungarian national movement by imprisoning Deák, Kossuth, and others of the leaders. The struggle continued till 1848, when the French Revolution of that year gave an impetus to a similar rising in Vienna. Prince Metternich fled to London, and the Viennese court made a formal concession of all important demands; but these had no sooner been granted than the Government began secretly to work against their being put in operation. The dependencies of the Hungarian crown, the Croats and the Wallachians of Transylvania, were privately encouraged to revolt, and in December of the same year an Austrian army took the field with the avowed object of annihilating the independence of Hungary; but a series of pitched battles resulted on the whole so much in favour of the Hungarians that Austria was obliged to call in the aid of Russia, which was at once granted. After an heroic struggle the Hungarians had to succumb. The nation was reduced to the position of a province, and some of the greatest statesmen and soldiers of Hungary perished on the scaffold. But the struggle was continued by the Hungarians in the form of a constitutional agitation, and at last, when the battle of Sadowa in 1866 separated Austria from Germany, Austria, left face to face with a nation almost as powerful and numerous as itself, felt compelled to submit. In 1867 a separate Constitution and administration for Hungary was decreed, and on 8th June the emperor and empress were crowned King and Queen of Hungary with the utmost pomp, according to the ancient ceremonies of a Hungarian coronation. The dualism of the Austrian Empire was thus finally constituted. It was indeed but the partial recognition of the fact that the empire was a heterogeneous assemblage of communities, bound together only by having fallen to the House of Habsburg. The relations between Austria and Hungary remained always contentious and even at times acute, as over the demand of Hungary for a separate national bank in 1909. The European War brought Hungary enthusiastically to the side of Austria, as the Magyars feared the Slavonic propaganda of Russia more than Austria. On 31st Oct., 1918, a revolution broke out in Hungary, and on 13th Nov. King Charles abdicated. On 16th Nov. Hungary was proclaimed an independent republic, with Count Michael Karolyi as Provisional President. Count Karolyi resigned on 22nd March, 1919, and his Cabinet was succeeded by a Bolshevist ministry which proclaimed the dictatorship of the proletariat. The leader was Bela Kun, who set up a Soviet Government. An opposition Government was set up at Arad and Szeged, and with the assistance of the Roumanian army, which had invaded Hungary, Bela Kun's Government was overthrown, and a new Government under Archduke Joseph was established on 7th Aug., 1919. As the Supreme Council, however, refused to recognize the Archduke's Government, and declared that no Habsburg should have a place in Hungary's Constitution, he resigned, and Admiral von Horthy was elected Regent or Protector of the Hungarian Republic on 1st March, 1920. On 23rd March, 1920, the Cabinet issued a declaration that Hungary was a monarchy, and should be so described in all official documents. The Treaty of Trianon, between Hungary and the Allies, was signed at the Grand Trianon, Versailles, on 4th June, 1920. In March and Oct., 1921, two *coups d'état* to restore Charles of Habsburg as King of Hungary failed.—BIBLIOGRAPHY: A. Vambéry, *Hungary in Ancient and Modern Times*; P. Alden, *Hungary of To-day*; E. Sayous, *Histoire générale des Hongrois*; Papp and Erdelyi, *Les Magyars peints par eux-mêmes*; A. B. Yolland, *Hungary*; A. de Hevesy, *Nationalities in Hungary*; Louis Leger, *History of Austria-Hungary*.

Hungarian Literature.—Hungarian literature is mostly of modern origin, i.e. dating from the beginning of the nineteenth century. With the introduction of Christianity into Hungary, Latin became the dominant language and the medium of literary expression. Poetical efforts were, however, made in the vernacular during the early Middle Ages, and there is a version of the Bible in Hungarian dating from the fourteenth century. Lyric poetry was cultivated during the sixteenth and seventeenth centuries, and Gyöngyös, Liszti, and particularly Count Nicholas Zriny (The Siege of Szigetoar) may be mentioned. The development of Hungarian literature was stopped by the Austrian Government at the beginning of the eighteenth century, but towards 1780 a reaction ensued, a literary awakening took place, and the renaissance of the national Hungarian spirit was inaugurated. Ferenez Kazinczy (1759–1831) reformed the language, and George Bessenyei (1747–1811) wrote plays, whilst Rath started the first newspaper in Hungarian. Since then Hungarian literature has developed considerably, but we can only mention a few names, such as Alex. Kisfaludy, Ferenez Kolcsey, and Arany, from among the numerous poets. Among fiction writers the following may be mentioned: Janos Erdelyi (1814–68), Michael Tompa (1817–68), Nicholas Josika (1794–1865), Jozsef Eötvös (1813–71), Sigismund von Keményi (1816–75), Maurice Jokai (1825–1904), Herczeg, and Sigismund Brody.—Cf. E. Reich, *Hungarian Literature*.

Hunger, a craving for food. It is a feeling partly due to the distention of the muscular wall of the stomach, from which nervous impulses pass to the brain, since it may be relieved temporarily by the introduction into the stomach of material which is incapable of yielding any nutriment to the body. But it also arises from a condition of the system, since the introduction of nutriment into the blood, apart altogether from the stomach, will relieve it. This is also evident from the fact that hunger may be experienced even when the stomach is full of food, and when food is supplied in abundance, if some disease prevents the absorption of the nourishment, or quickly drains it from the blood. Hunger may be partially allayed by sleep or by the use of narcotics, tobacco, and alcohol, all of which tend to diminish the disintegration of tissue.

Huningue (Ger. *Hüningen*; hụ'ning-en), a town of France, in Upper Alsace, formerly fortified. It has a famous fish-breeding establishment. From 1871 to 1918 it was in German possession. Pop. 3500.

Huns (Lat. *Hunni, Chunni*), a nomadic and warlike people of Asia, of Mongolian race, part of whom entered Europe, probably in the fourth century after Christ, conquered the Alans, and drove the Goths out of Dacia. They continued to extend their dominion along the Danube till the time of Attila (A.D. 434), who, taking the whole Hunnish power into his hands, became the most powerful prince of his time. (See *Attila*.) His defeat near Châlons was the commencement of the decline of the power of the Huns, and within a generation after his death, in 453, the great Hunnish Empire had completely disappeared, and the race been absorbed amongst other barbarous peoples. The term Huns was used by ancient and mediæval writers in a very vague way to indicate barbarous hordes invading Europe from the north-east. The Huns are described as a race of dark complexion with small black eyes, flat noses, and broad shoulders. During the European War the name Huns was commonly applied to soldiers of the German army, partly on account of their ' frightfulness ', and partly because in 1900 the ex-Kaiser thus addressed troops embarking at Bremershaven for China: "No quarter will be given, no prisoners will be taken. Let all who fall into your hands be at your mercy. Just as the Huns a thousand years ago, under the leadership of Attila, gained a reputation in virtue of which they still live in historical tradition, so may the name of Germany become known in such a manner in China that no Chinaman will ever again even dare to look askance at a German."—Cf. J. Hodgkin, *Italy and her Invaders*.

Hunstanton, English watering-place, in Norfolk, on the Wash, with fine sands, good bathing, golf-links, &c. Pop. 2510.

Hunt, Alfred William, British landscape-painter, born at Liverpool 18th Nov., 1830, died 3rd May, 1896. Educated at Oxford, he became a Fellow of Corpus Christi College in 1858. In 1851 he wrote the Newdigate Prize poem, and in 1854 he exhibited a landscape at the Royal Academy. He excelled in water-colours, and in 1864 was elected a member of the Old Water Colour Society. Examples of his work are in the Tate Gallery, London, and in the Walker Art Gallery, Liverpool.

Hunt, James Henry Leigh, an English poet and essayist, born in 1784, died in 1859. He was educated at Christ's Hospital, where he attained some distinction, entered the office of his brother, an attorney, and afterwards obtained a situation in the War Office. In 1808, in conjunction with his brother John, he started *The Examiner* newspaper, which soon became prominent for the fearlessness with which public matters were discussed. Ere long official resentment took shape in two prosecutions of the brothers, the second of which, occasioned by an article in the paper of 22nd March, 1812, reflecting on the character of the Prince Regent, resulted in the brothers being sentenced to pay a fine of £500 each, and to suffer two years' imprisonment. During his confinement Hunt wrote several works, amongst which are *The Feast of the Poets*, *The Descent of Liberty*, and *The Story of Rimini*. In 1818 appeared *Foliage*, a collection of original poems and translations from Homer, Theocritus, Bion, &c.; and in 1819 *The Indicator* was started, a weekly journal on the model of *The Spectator*, which contained some of his best essays. In 1822 he proceeded to Italy, having received an invitation thither from Byron and Shelley, and, in conjunction with the former, carried on a newspaper called *The Liberal*; but it proved unsuccessful. On his return to England Hunt published *Recollections of Lord Byron and some of his Contemporaries* (2 vols., 1828), which provoked somewhat the indignation of the noble poet's friends. Among his subsequent works may be mentioned: *A Legend of Florence*, a play represented with some success at Covent Garden in 1840; *Stories from the Italian Poets* (2 vols., 1846); *Men, Women, and Books* (1847); *A Jar of Honey from Mount Hybla* (1847); *The Town: its Memorable Characters and Events* (1848); *Autobiography* (3 vols., 1850); *Table Talk* (1850). In 1842 Mrs. Shelley settled an annuity of £120 upon Leigh Hunt, and in 1847 a Government pension of £200 a year was bestowed on him.—Bibliography: C. T. Winchester, *A Group of English Essayists*; B. Miller, *Leigh Hunt's relations with Byron, Shelley, and Keats*.

Hunt, William Holman, English painter, born in 1827 at London, died 1910. He was trained in the Royal Academy school, and began to exhibit in 1846; and with Millais and Rossetti founded the Pre-Raphaelite Brotherhood. (See *Pre-Raphaelite Brotherhood.*) In 1853 his *Claudio and Isabella* (now in the Tate Gallery) attracted public attention, followed next year by his first great success, *The Light of the World*, now at Keble College, Oxford. In 1854 he made a journey to the East, the fruits of which are observable in the local colour and realistic detail of a long series of religious pictures including *The Scapegoat* (1856); *The Finding of the Saviour in the Temple* (1860); *The Shadow of the Cross* (1873); *Plains of Esdraelon* (1877); and *Triumph of the Innocents* (1885), now in the National Gallery. Among his genre paintings are: *Isabella and the Pot of Basil*, *The After-Glow*, *The Festival of St. Swithin*, *Mayday*, and *Magdalen Tower*. Towards the end of his life he received the Order of Merit. In 1905 he published *A History of Pre-Raphaelitism*.—Bibliography: G. C. Williamson, *W. Holman Hunt*; T. L. Hare, *Leaders of English Pre-Raphaelites*.

Hunter, John, surgeon and physiologist, was born at Long Calderwood, Lanarkshire, in 1728, died in 1793. He assisted his brother-in-law, a carpenter in Glasgow, for some time in his trade, but afterwards went as assistant to his brother William, a prosperous surgeon in London. In 1756 he was appointed house-surgeon at St. George's Hospital, and also lectured in his brother's school of anatomy. In 1760, his health needing a change of climate, he became staff-surgeon and went with the army to Portugal. Three years afterwards he returned to London, and, in 1768, was appointed surgeon to St. George's Hospital; in 1790 surgeon-general to the army, and inspector-general of hospitals. Hunter contributed greatly to the high development of English surgery, as well as to the advance of anatomy and physiology. One of his chief works was his *Treatise on the Blood, Inflammation, and Gun-shot Wounds* (1794). His valuable museum of surgical and anatomical subjects was purchased by the Government and presented to the Royal College of Surgeons.—Cf. G. R. Mather, *Two Great Scotsmen, W. and J. Hunter*.

Hunter, William, physician and anatomist, elder brother of the preceding, was born at Long Calderwood, Lanarkshire, in 1718, died in 1783. He studied at Glasgow with a view to entering the Church, but abandoned theology for medicine. In 1741 he went to London, where he became a member of the College of Surgeons; acquired a large practice in surgery and midwifery; was appointed accoucheur to the British Lying-in Hospital, and in 1764 physician-extraordinary to the queen; in 1767 a Fellow of the Royal Society; and in 1780 foreign associate of the Royal Medical Society of Paris. In 1770 he established a theatre of anatomy for his own lectures and a splendid museum for his anatomical preparations, objects of natural history, pictures of ancient coins and medals, &c. He was the author of some important works, in particular the *Anatomy of the Human Gravid Uterus*, published in 1774. He bequeathed the whole of his splendid museum, valued at £150,000, to the University of Glasgow, with the sum of £8000 in cash to be expended in a building for its reception, and a further sum of £500 per annum to bear the charges of its preservation.

Hunting, a term used in engineering to describe the normal variations in the speed of a prime mover which take place above and below the normal running speed. These variations of speed are brought about by changes in the supply and demand of energy to and from the engine. If the governor responds too quickly to changes of load, it will supply more or less than the proper amount of energy, and these differences must be absorbed by the rotational kinetic energy of the engine, with consequent changes in its speed. For this reason, governors are usually deliberately made sluggish in their action by fitting dashpots and similar contrivances to them. For instance, in a power-station where six turbo-alternators share the load, if one has a sensitive governor and the other five sluggish ones, the five will run under beautifully steady conditions, whereas all the 'give' and 'take' of load of the whole power-station will be thrown upon the sixth. The conditions for the five machines are ideal, but the sixth machine is operated under severe conditions. It is usually considered wise to try to share the variations in load among the machines equally.

Hunting Cog, an extra cog put into a pair of cog-wheels to prevent a pair of teeth coming into contact too frequently. For instance, if a cog-wheel A has 60 teeth and a cog-wheel B has 20, the same pair of teeth will come into contact after every revolution of A, or after every three revolutions of B. Also, after every three revolutions of B a particular tooth of A will come in contact with a particular tooth on B, and a particular tooth on B will come in contact in turn with three definite teeth on A. If now the number of teeth on A be increased from 60 to 61, the velocity ratio of the pair of wheels would scarcely be changed, but the same pair of teeth will now only come in contact after 20 revolutions of A or 61 revolutions of B, and each tooth on one wheel will now come in contact in turn with every tooth on the other wheel. This ensures even wearing of the teeth.

Huntingdon, Selina, Countess of, was born in 1707, died 17th June, 1791. She married, in 1728, the Earl of Huntingdon, became a widow in 1746, and, adopting the principles of the Methodists, was long considered, owing to her rank and fortune, as the head of the Calvinistic Methodists. The religious movement founded by Lady Huntingdon came to be known as the Countess of Huntingdon's Connection. She founded a college at Trevecca, in Wales, for the education of ministers, built numerous chapels, and contributed liberally to the support of the clergy. In 1792 the college was removed to Cheshunt and in 1905 to Cambridge.—BIBLIOGRAPHY: A. H. New, *The Coronet and the Cross*; Sarah Tytler, *The Countess of Huntingdon and her Circle.*

Huntingdon (contracted *Hunts*), a small inland county of England, surrounded by the counties of Northampton, Cambridge, and Bedford; area, 233,985 acres. The north-eastern portion is included within the great Fen district, and is principally devoted to grazing. The soil is clayey and has been much improved in productiveness by scientific farming. Five-sixths of the total area is under crops and permanent pasture. Cattle-rearing, market-gardening, and in the Fen portion the cultivation of willows are amongst the principal employments. The manufactures are unimportant. The county returns one member to Parliament. Pop. (1921), 54,748. —The county town, *Huntingdon*, 59 miles north by west of London, on the north bank of the Ouse, has breweries, brickworks, and carriage-works, as well as large nurseries in the neighbourhood. Oliver Cromwell was born and went to school here. Pop. (1921), 4194.

Hura, a genus of tropical American plants, nat. ord. Euphorbiaceæ. *H. crepitans*, the sand-box tree, is remarkable for the loud report with which its seed-vessel bursts. It is a large branching tree with glossy poplar-like leaves, inconspicuous diœcious flowers, and large, furrowed, roundish fruits of the size of an orange.

Hurdy-gurdy, a stringed instrument, played by turning a handle. Its tones are produced by the friction of a wheel acting the part of a bow against four strings, two of which are pressed by the fingers or by keys. The other two strings are tuned a fifth apart to produce a drone bass, and are not stopped by the fingers or keys. The term is now loosely applied to any kind of grinding organ.

Huron, Lake, one of the five lakes on the frontiers of the United States and Canada. It is the third in size, being 218 miles long north and south, and (including Georgian Bay) 180 miles broad at its widest part, with an area of about 21,000 sq. miles. It lies 578 feet above sea-level. The lake contains several thousand islands, varying in size from a few square feet to huge islands like the Great Manitoulin, which is about 107 miles long and from 4 to 25 miles wide, and is the only one inhabited. The waters are very clear and pure, abound in fish, and have a depth averaging from 800 to 1000 feet.

Huronian Rocks, in geology, a term first applied to certain rocks on the banks of Lake Huron, consisting of quartzite, with masses of chloritic schist. The Huronian series of North America are clearly of sedimentary origin; they are often penetrated by intrusive masses, and underlie the fossiliferous Cambrian strata unconformably. Below them is the great complex of crystalline rocks to which the term Archæan is now often restricted.

Husband and Wife. Recent legislation in most countries has been in the direction of putting husband and wife on an equality, whereas formerly the wife to a great extent lost her separate status on marriage. Thus, for instance, by the English common law her personal property passed at once to her husband on marriage, though this might be obviated by special settlements. But the law no longer stands so, especially since the Act of 1882. By this statute a married woman can acquire, hold, and dispose of, by will or otherwise, property as if she were an unmarried woman, and may enter into any contract, and sue or be sued without the participation of her husband. A woman carrying on a business separately from her husband is subject to the bankruptcy laws as if she were unmarried. Every married woman has, even against her husband, the same civil remedies, and also the same remedies by way of criminal proceedings for the protection and security of her own property, as if she were unmarried; but she cannot take criminal proceedings against her husband while they are living together. Generally a husband is not bound by the contracts of his wife unless they are made by his express or implied authority. See *Marriage*; *Divorce*; *Adultery*; *Settlement*; *Will*; *Intestacy*.

Hus'kisson, William, English statesman, born in 1770, died 15th Sept., 1830. In 1790 he was appointed secretary to Lord Gower, the British Ambassador at Paris, and in 1795 became Under-Secretary for War and the Colonies. In 1796 he became member of Parliament for Morpeth, and in 1804 Secretary of the Treasury in the Pitt administration. In 1814 he was appointed Chief Commissioner of Woods and Forests; he was returned for Liverpool in 1823, and made President of the Board of Trade. In 1827 he became Secretary of State for the Colonies, under Lord Goderich. He had now come to be a recognized authority on all questions of trade and commerce. In 1828 a misunderstanding with the Duke of Wellington, then at the head of the Cabinet, led to his withdrawing, along with other Tories, from the administration. He was accidentally killed at the opening of the Liverpool and Manchester Railway.

Huss, or **Hus**, John, Bohemian religious reformer, born about 1373, burned alive 6th July, 1415. He studied at the University of Prague, took the degree of Master of Arts in 1396, and in 1398 began to lecture on theology and philosophy. In 1401 he was made dean of the faculty of philosophy, became the leader of the Bohemian in opposition to the German professors and academicians, and after the withdrawal of the latter to Leipzig, was made rector of the university (1409). Since 1391 he had been acquainted with the writings of Wycliffe, and his denunciation of the Papal indulgences, of masses for the dead, and of auricular confession. alarmed Archbishop Sbynko of Prague, who had 200 volumes of Wycliffe's writings burned (1410) in the archiepiscopal palace, and the preaching in Bohemian prohibited. Huss appealed to the Pope, John XXIII, who summoned him to appear at Rome. Huss refused to appear, and was in consequence excommunicated, and Prague laid under an interdict as long as Huss should remain in it. The people of Prague, however, stood by their preacher, and the Pope was compelled to acquiesce. But the quarrel broke out again when Huss and his friend Jerome publicly condemned the Papal indulgences granted for the crusade against Ladislaus of Naples. Huss was again excommunicated and Prague interdicted. The reformer now retired to Hussinatz to the protection of his feudal lord, and here he wrote his books *On the Six Errors* and *On the Church*, in which he attacks transubstantiation, the belief in the Pope and the saints, the efficacy of the absolution of a vicious priest, unconditional obedience to earthly rulers, and simony, which was then extremely prevalent, and makes the Scriptures the only rule of matters of religion. The approbation with which these doctrines were received, both among the nobility and common people, increased the party of Huss in a great degree, and emboldened him to comply with the summons of the Council of Constance to defend his opinions before it. The Emperor Sigismund, by letters of safe conduct, became responsible for his personal safety; and John XXIII, after his arrival at Constance, 4th Nov., made promises to the same effect. Notwithstanding this, Huss was thrown into prison, 28th Nov., and after several public examinations, conducted with little regard to justice and the rights of the accused, he was sentenced to death on 6th July, 1415, and burned alive the same day, and his ashes thrown into the Rhine. See *Hussites*.—BIBLIOGRAPHY: Count Lützow, *Life and Times of Master J. Huss*; H. B. Workman, *The Age of Huss*; H. C. Lea, *History of the Inquisition of the Middle Ages*.

Hussars, the name given to certain regiments of light cavalry formerly known in the British service as light dragoons. The name *hussars* has its origin in Hungary, where troops of light cavalry known by that name and largely composed of petty Magyar landowners were employed in the imperial armies as scouts and foragers. It does not appear that these original hussars were considered of any great value as soldiers, and during the Thirty Years' War they were usually looked on as marauders and, if captured, slaughtered out of hand.

The full-dress uniform of British hussars is distinctive and effective, but in service dress there is little to distinguish an hussar regiment from any other. In the British service the first light dragoon regiment to be dressed and armed as hussars was the 7th, now the 7th (Queen's Own) Hussars, and the uniform selected was an adaptation of that in favour in Hungary. There the native hussar was accustomed to wear hanging from his left shoulder a short embroidered jacket or sleeved cloak. This, no doubt, was originally merely a convenient method of carrying an extra protection against the inclemency of the weather, but it also performed the no less useful duty of protecting the bridle arm to some extent from a sword cut. It is probable that when the English hussar went to Hungary for his fashions the original and obvious use of the garment had been lost sight of, and the dolman, as it was called, was retained merely as an ornament, and as such it was taken into use by our English hussars. Old prints of hussars invariably show this garment being worn, but it is now many years since its use has been discontinued. Other outstanding features of the hussar uniform are the head-dress or busby, embellished with a coloured flap or ' bag ' on the right side, and carrying a stiff plume, usually of a different colour, in front. Officers' chargers carry a ' throat plume '.

Hussar regiments in the English army are: 3rd (King's Own) Hussars (1685), uniform, blue; collars, scarlet; busby-bag, garter blue; plume, white. 4th (Queen's Own) Hussars (1685), uniform, blue; busby-bag, yellow; plume, scarlet. 7th (Queen's Own) Hussars (1688), uniform, blue; busby-bag, scarlet; plume, white. 8th (King's Royal Irish) Hussars (1688), uniform, blue; busby-bag, scarlet; plume, red and white. 10th (Prince of Wales's Own Royal) Hussars (1715), uniform, blue; busby-bag, scarlet; plume, black and white. 11th (Prince Albert's Own) Hussars (1715), uniform, blue; overalls, crimson; busby-bag, crimson; plume, crimson and white. 13th Hussars (1715), uniform blue; collars, buff; busby-bag, buff; plume, white. 14th (King's) Hussars (1715), uniform, blue; busby-bag, yellow; plume, white. 15th (The King's) Hussars (1759), uniform, blue; busby-bag and plume, scarlet. 18th (Queen Mary's Own Royal) Hussars (1759), uniform, blue; busby-bag, blue; plume, scarlet and white. The 19th (Queen Alexandra's Own Royal) Hussars (1858) and 20th Hussars (1858) are now (1921) under orders for disbandment.

The height of recruits for hussars should be between 5 feet 4 inches and 5 feet 8 inches, and the age between eighteen and twenty-five, while the weight should be not more than 11 stone. Hussars are armed with sword and carbine. (The dates in brackets are those of the first raising of the regiment as horse or light dragoons.)

Hussein, Ibn Ali, Grand Shereef of Mecca and first King of Hejaz, born in 1851. A scion of the family of the Katada, in which the Shereefate of Mecca has been vested, since the twelfth century, he lived as a prisoner at Constantinople from 1890 to 1908. After the Turkish Revolution he was appointed Grand Shereef of Mecca by the Committee of Union and Progress. During the European War he proclaimed (in 1916) the independence of Arabia and joined the Allies against the Turks; organized the Arab forces, and placed the northern army under the command of his son, the Emir Feisul. In July, 1916, his army captured the port of Medina and assisted the Allies in defeating the Turks. Hussein was recognized as King of Hejaz by the end of 1916. His son Feisul was elected King of Irak in Aug., 1921.

Hussein Kamil, Sultan of Egypt, born 20th Dec., 1853, died 9th Oct., 1917. A son of Ismail Pasha, he was educated in Paris, where he was on intimate terms with the family of Napoleon III. He returned to Egypt in 1870, held several important posts, but had to leave the country during the troubles of 1879, and lived in Italy. Returning to Egypt after the fall of Arabi Pasha, he became President of the Legislative Council in 1909. When Egypt was declared a British Protectorate in 1914, Hussein was appointed first Sultan of the country. He was succeeded in 1917 by his brother Fuad, born 1868.

Hussites, the followers of John Huss. After the death of Huss, his adherents took up arms for the defence of their principles, and, under the leadership of Johann Ziska, captured Prague, fortified Mount Tabor, and repeatedly defeated the troops sent against them by the Emperor Sigismund, who had succeeded to the crown of Bohemia. Ziska died in 1424, and was succeeded by Procopius, who also distinguished himself by many victories. The excesses of this party, however, who were called the *Taborites*, alienated the moderate Hussites, who called themselves *Calixtines*, and who finally united with the Catholics by the Compact of Prague in 1433 to acknowledge Sigismund as king, certain concessions, especially the use of the cup for the laity, having been made to them by the Council of Basel. The Taborites, thus weakened, were totally defeated at Bömischbrod on 31st May, 1434, and afterwards declined as a political party, finally becoming merged in the Bohemian Brethren. See *Bohemia*; *Bohemian Brethren*.—BIBLIOGRAPHY: Count Lützow, *Life and Times of Master J. Huss*; Ernest Denis, *Huss et la guerre des Hussites*; J. E. Hutton, *A History of the Moravian Church*.

Hustings (Scand. *hus*, house, and *thing*, meeting), (1) a name given to a court formerly held in many cities of England, as York, Winchester, Lincoln, but especially applied to the county court of the city of London held before the Lord Mayor, recorder, and sheriffs. (2) The platform from which candidates for seats in Parliament addressed the constituency on their nomination previous to the Ballot Act of 1872.

Hutch'eson, Francis, philosophical writer, born in Ireland in 1694, died in 1746. He studied at the University of Glasgow from 1710 to 1716, was licensed to preach, but set up a private academy in Dublin. In 1725 his celebrated *Inquiry into the Ideas of Beauty and Virtue* appeared, followed in 1728 by his *Treatise on the Passions.* In 1729 he was called to the chair of moral philosophy at Glasgow. The main features of his philosophical teaching are the theory of a distinct moral sense or conscience peculiar to man, and his view of virtue as benevolence. Hutcheson's moral philosophy is strongly opposed to the empiricism of Locke, and in this respect he may be considered as the precursor of Reid and the Scottish school. In 1755 a *System of Moral Philosophy* was published at Glasgow by his son from his MSS.—Cf. James Martineau, *Types of Ethical Theory.*

Hutch'inson, John, an English officer of the Parliament, and Governor of Nottingham Castle during the great Civil War, was born at Nottingham in 1616, died in 1664. He studied at Cambridge, and afterwards went to London to study law. In 1638 he married Lucy, the daughter of Sir Allen Apsley. On the outbreak of the Civil War he joined the popular party, and was appointed Governor of Nottingham Castle, which he defended against the Royalists with great skill and gallantry. On the termination of the war he was returned to Parliament for his native town, and was a member of the high court of justiciary which condemned the king to death, but subsequently retired from public life because he disapproved of Cromwell's arbitrary conduct as ruler. After the Restoration Colonel Hutchinson was arrested and died in prison. His wife wrote a memoir of his life which is amongst the most valuable and interesting of its kind in English literature. The book was first published in 1806, and an edition by C. H. Firth appeared in 1885.

Hutten, Ulrich von, a German knight, distinguished for the influence which his writings exercised upon the Reformation, was born at the family castle of Steckelberg on the Main, in 1488, died in 1523. He was educated at the famous monastic school of Fulda. Hutten led a wandering and unsettled life, sometimes appearing as the man of letters and controversialist, at other times as the soldier. His first attacks on the Roman Church were in connection with his defence of the persecuted Reuchlin, and with the issuing of the *Epistolæ Obscurorum Virorum* (q.v.). In 1517 he was crowned laureate at Augsburg, and knighted by the emperor. A year or two after he retired to his paternal castle to write work after work, addressing the people, like Luther, in their native German, and denouncing the arrogance and corruption of Rome. The Roman authorities at length began to move against him, and he fled to the castle of his friend Franz von Sickingen, and from that again to Switzerland. He went to Basel, but was received coldly by Erasmus, who did not approve of his extreme measures. He died on the Island of Ufnau in the lake of Zürich.—Bibliography: D. S. Jordan, *Ulrich von Hutten, Knight of the Order of Poets*; D. F. Strauss, *Ulrich von Hutten.*

Hutton, James, Scottish geologist, born at Edinburgh in 1726, died in 1797. He studied at the university there and at Leyden, where he graduated as M.D. in 1749. Returning to Scotland, he settled for a time on a farm of his own in Berwickshire, but about 1768 went to Edinburgh, and devoted himself to scientific researches. His name is especially connected with a geological system, the chief features of which are his recognition of the similarity of processes in the past and present, and his theory of igneous fusion as accounting for most geological phenomena. Among his numerous works are *An Investigation of the Principles of Knowledge*; *Theory of Rain*; and *Theory of the Earth, with Proofs and Illustrations* (1795).

Huxley, Thomas Henry, English biologist, born 4th May, 1825, died at Eastbourne 29th June, 1895. He graduated M.B. at the University of London in 1845, and entered the Royal Navy as assistant-surgeon in 1846. He sailed with H.M.S. *Rattlesnake* on a surveying expedition to Australasia, during which he sent a number of valuable papers to the Royal Society. He became professor of natural history at the School of Mines, Fullerian professor of physiology at the Royal Institution, and Hunterian professor at the Royal College of Surgeons. Subsequently he was president of the British Association meeting held at Liverpool in 1870, lord-rector of Aberdeen University in 1872, secretary of the Royal Society, substitute professor of natural history for Professor Wyville Thompson at Edinburgh in 1875 and 1876, and a member of various Royal Commissions on fisheries, vivisection, and universities, and Inspector of Salmon Fisheries. In 1885, however, he resigned most of his appointments on account of ill-health. Amongst his works are: *The Oceanic Hydrozoa* (1857); *On the Theory of the Vertebrate Skull*; *Man's Place in Nature* (1863); *On our Knowledge of the Causes of the Phenomena of Organic Nature*, a series of lectures to workingmen delivered in 1862; *Elements of Comparative*

Anatomy (1864); *Elementary Physiology* (1866); *Introduction to the Classification of Animals* (1869); *Lay Sermons, Addresses, and Reviews* (1870); *Critiques and Addresses* (1873); *American Addresses* (1877); *Physiography* (1877); *Anatomy of Invertebrate Animals* (1877); *The Crayfish* (1879); and *Science and Culture* (1882). Huxley was famous not only for his powers of research, but also for his gift of exposition, and his lectures and papers were models of accuracy and clearness.—BIBLIOGRAPHY: Leonard Huxley, *Life and Letters of Thomas Henry Huxley*; P. C. Mitchell, *Thomas Henry Huxley: a Sketch of his Life and Work.*

Huy (wē), a town of Belgium, province of and 18 miles south-west of Liége. It has a strongly-fortified citadel. The town was occupied by the Germans during the European War. Pop. 14,000.

Huygens (hoi′gens), Christiaan, Dutch mathematician and physicist, born in 1629, died at The Hague in 1695. He studied at Leyden, and at Breda, where he went through a course of civil law from 1646 to 1648. He made several journeys to Denmark, France, and England; in 1666 settled in Paris at the invitation of Colbert, and remained there till 1681, when he returned to Holland on account of his health. Among his most important contributions to science are his investigations on the oscillations of the pendulum, and his *Systema Saturnium*, in which he first proved that the ring completely surrounds the planet, and determined the inclination of its plane to that of the ecliptic. In 1690 he published important treatises on light and on weight. His *Traité de la Lumière* was founded on the undulatory theory, but in consequence of the prevalence of the Newtonian theory it was long neglected till later researches revealed its value.

Huysmans, Joris Karl, French novelist, of Dutch descent, born in Paris 5th Feb., 1848, died there on 13th May, 1907. Influenced by Zola and the Goncourts, Huysmans was at first a realist, but he soon abandoned sensual materialism (*En ménage*, 1881), and turned his attention to the study of spiritualism (*À rebours*, 1884), of decadence and Satanism (*Là-bas*, 1891). He then turned to the contemplation of religious mysticism in *En route* (1895), and finally to devout Catholicism in *La Cathédrale* (1898) and *L'Oblat* (1902). He also wrote *Les Foules de Lourdes* (1906).

Huysum (hoi′sųm), Jan van, distinguished Dutch flower and fruit painter, born at Amsterdam in 1682, died there 1749. He worked at first with his father, Justus Huysum, a picture-dealer and painter, but afterwards set up on his own account, devoting himself, in emulation of de Heem, to the painting of fruit and flowers. In this he attained great skill, his work being marked by brilliance of colour, exquisite finish, and decorative quality. He was extremely jealous of rivalry, and kept his methods of working and preparation of colours a deep secret. His landscapes, though painted with great care and delicacy, are cold and lifeless. His brother *Justus* (born 1684) was a battle painter, and died at the age of twenty-two years. Another brother, *Jakob* (born 1687), copied his brother's flower and fruit pieces so perfectly that they have been mistaken for that master's work. In 1721 he came to England, where he died in 1740.

Hy′acinth, a genus of liliaceous bulbous plants, including about thirty species, amongst which the garden hyacinth (*Hyacinthus orientālis*) is celebrated for the innumerable varieties which culture has produced from it. It is a native of the Levant, and was first cultivated as a garden flower by the Dutch about the beginning of the sixteenth century. See *Blue-bell.*

Hy′acinth, or **Jacinth**, a variety of the mineral zircon (q.v.). Its prevailing colour is red, more or less tinged with yellow or brown. The name hyacinth is also given to varieties of the garnet cinnamon stone, the sapphire, and topaz.

Hyacinthe, Père, Charles Jean Marie Loyson, French Carmelite and eminent preacher, born at Orleans 10th March, 1827, died 8th Feb., 1912. Educated at Pau, and at the Theological Seminary of St. Sulpice, Paris, he was ordained a priest in 1851. He entered the order of Carmelite monks, and became one of the most famous preachers of his day, attracting vast crowds to the Madeleine, Notre Dame, and St. Sulpice. Suspended on a charge of indiscipline, for denouncing the abuses of the Church, he obtained a dispensation from his monastic vows, and became Abbé Loyson. In 1870 he joined the Old Catholic movement, protesting against the infallibility of the Pope, and in 1872 he married an American lady in London. In 1879 he founded a Gallican church in Paris, where he served as rector for several years. His works include: *La Société civile dans ses rapports avec le Christianisme* (1867), *Programme de la réforme Catholique* (1879), *Mon Testament* (1893), and *Christianisme et Islamisme* (1895).

Hy′ades, a cluster of stars in the constellation Taurus, near the bright Aldebaran. The name, derived from the Greek verb, *hyein*, to rain, was given because the rainy season followed their rising with the sun.

Hyæna, a digitigrade carnivorous mammal belonging to a family which is closely allied to the civet cats (Viverridæ). Habits gregarious. Feet four-toed, and armed with non-retractile claws. Tail short; ears large and pointed; eyes prominent. No scent-glands. Five upper and four lower grinding teeth on each side. Jaws and teeth unusually powerful, and adapted for crushing bones. They are nocturnal animals, extremely voracious, feeding chiefly on carrion, and thus being of great utility in the countries where they live; to obtain dead bodies they will even dig up graves. There are three recent genera. Crocuta includes the spotted hyæna (*C. maculata*) of South Africa, and Hyæna, native to Africa and Asia, comprises the striped and brown hyænas (*H. striata* and *H. brunnea*). The third genus, Proteles, sometimes referred to a special family, has but one species (*P. cristata*), the South African aard wolf, an aberrant maned form, with five toes on the fore foot and comparatively feeble teeth. In addition to carrion, it feeds on insects, especially termites (white ants). The extinct five-toed Ictitherium links hyænas with civet-cats. The cave hyæna, common in Europe (including Britain) during prehistoric times, is hardly to be distinguished from the spotted form, but was formerly considered a distinct species (*Hyæna spelæa*).

Striped Hyæna (*Hyæna striata*)

Hy′alite, a pellucid variety of opal, appearing in mammillated forms in the cavities of lavas. See *Opal*.

Hybrid, the offspring of two organisms belonging to different species (species hybrid), or more rarely to different genera (genus hybrid). The term is sometimes extended to a cross between two varieties or races of the same species, but to this the name *mongrel* is more properly applied. It is, however, only a case of degree, for varieties must be regarded as species in the making. A further difficulty arises from the fact that in some cases, particularly among plants, the distinction between species and varieties is far from clear, e.g. in willows, hawkweeds, and brambles. Hybrids are typically sterile, as illustrated by the genus hybrids produced by crossing pheasants and fowls, or the species hybrids (mules) which result from the mating of horses with asses or zebras. Mongrels, on the other hand, are particularly fertile, e.g. the numerous races of domestic cattle, dogs, and pigeons. The characters of mongrels are largely intelligible in the light of Mendelian principles (see *Mendelism*), which doubtless also apply to hybrids, though here our knowledge is very incomplete. The results of crossing are extremely varied, and fall into five chief groups. (1) Hybrids which are intermediate between the parents, e.g. mulattoes, crosses between finch and canary. (2) Hybrids possessing paternal and maternal characters side by side, not blended, e.g. piebalds, many pheasant crosses. (3) Hybrids which revert to an ancestral type, e.g. some pigeon crosses closely resembling the wild rock-dove, which is believed to represent the original stock. (4) Hybrids which differ from both parents, e.g. Andalusian fowls. (5) Hybrids which, in a given character, resemble one parent, e.g. most Mendelian crosses. Hybrids and mongrels occur in nature more commonly than is supposed, but the most familiar cases have been produced artificially by plant-breeders and animal-breeders. The first recorded plant hybrid was raised in England by Fairchild, who crossed two species of pinks (*Dianthus caryophyllus* and *D. barbatus*) in 1717. Kölreuter was the first to hybridize plants on a large scale, his first hybrid (between *Nicotiana rustica* and *N. paniculata*) flowering in 1761. A great deal of plant hybridizing has been done of late years, mostly for the purpose of producing improved races of various crops, such as wheat immune against rust, and the bulk of this work has been on Mendelian lines. Very interesting and practically valuable results have also been attained by crossing different kinds of fruit-yielding plants. The most familiar case is that of the loganberry, a hybrid between blackberry and raspberry, named after Judge Logan, who originated it in California. The northward range of citrus-growing in the United States has been extended by crossing the sweet orange (*Citrus aurantiaca*) with a hardier Japanese species (*C. trifoliata*), the result being a cold-resisting hybrid. On the other hand, the southern range of profitable pear-growing in the States has been much extended by the introduction of the Kieffer pear, a cross between the common species (*Pyrus communis*) and *P. sinensis*, which is drought-resisting.

Species hybrids among animals are usually of little economic value, though the common mule is a notable exception, and zebra mules, hybrids between horse and zebra, seem likely to have a future, for they are more docile than the ordinary kind while capable of the same sort of work. The mongrel races of domestic cattle, sheep, pigs, poultry, &c., are being continually improved by crossing, and Mendelian principles throw much light on directions which it is profitable to pursue.—BIBLIOGRAPHY: Charles Darwin, *Variations of Animals and Plants under Domestication*; André Suchetet, *Des Hybrides à l'état sauvage*; W. Bateson, *Mendel's Principles of Heredity*; Cossar Ewart, *The Penycuik Experiments*

Hydathode, in botany, a pore or gland for the secretion of water or other liquid. These structures are frequently present on leaves, and much of the so-called 'dew' seen on grass, &c., in the early morning is actually the liquid exuded from such organs, which are generally most active at night.

Hyde, a town of England (municipal borough), in Cheshire, about 7 miles E.S.E. of Manchester, giving name to a parliamentary division of the county; with cotton manufactures, coal-mines, iron-foundries, and engineering works. Pop. (1921), 33,437.

Hyde, or **Hide,** a measure of land, frequently mentioned in *Domesday Book* and in old English charters, and variously estimated as equivalent to 60, 80, and 100 acres—a fact which may be accounted for on the supposition that the quantity was always determined by local usage. It was such a portion of land as might be ploughed with one plough. The hyde at present is reckoned at 100 acres.

Hyde Park, a London park containing about 400 acres, and having on the west Kensington Gardens. Hyde Park derives its name from Hyde Manor, which belonged to the abbey of Westminster, and it became the property of the Crown on the dissolution of the monasteries in the reign of Henry VIII. It abounds with fine trees, and is the great fashionable promenade and public lounge of western London. It contains the Rotten Row, a special roadway reserved for equestrians; the Serpentine, a large sheet of ornamental water, much frequented in summer for bathing, and during frosts for skating; and the Albert Memorial, a structure in memory of the Prince Consort. In 1851 the first great international exhibition was held in Hyde Park, and the exhibition buildings, made of glass and iron, were afterwards re-erected at Sydenham as the Crystal Palace (q.v.).—Cf. Mrs. A. Tweedie, *Hyde Park: its History and Romance*.

Hyderabad, or **Haidarabad** (hī-dar-ä-bȧd′), a state of India, which comprehends the greater part of that central plateau of Southern India known as the Deccan, and is in possession of a Mahommedan prince, the Nizam; area, 82,698 sq. miles, exclusive of the Berar or Hyderabad Assigned Districts under British administration. The country is intersected or bounded by the Godavery, Kistnah, and their tributaries. The soil is fertile, though much good land is not yet brought under cultivation. The chief products are rice, wheat, maize, sugar-cane, tobacco, cotton, indigo, fruits, and timber. Pop. 13,375,000. The ruler of Hyderabad belongs to a dynasty founded by Asaf Jah, a distinguished soldier, whom the Emperor Aurangzib made Viceroy of the Deccan in 1713, with the title of Nizam or Regulator. Sir Usman Ali Khan, the present Nizam, came to the throne in 1911.

Hyderabad, the capital of the above state, is situated on the River Musi, at an elevation of 1672 feet above the sea. It is surrounded by a stone wall flanked with bastions, forming an irregular quadrangle about 2¾ miles long upon the river and 2 miles broad. Amongst the chief buildings are the extensive palace of the Nizam; the British residency; the Char Minar, or Four Minarets, built about 1590 as a Mahommedan college, but now used for warehouses; the Jama Masjid, or cathedral mosque, designed after the one at Mecca. There are manufactures of silks, trinkets, and turbans. In 1908 about 18,000 houses were destroyed by floods. Pop. 500,000.

Hyderabad, or **Haidarabad,** a town of Hindustan, capital of Hyderabad district, Sind. It is situated on a rocky eminence about 3 miles from the eastern bank of the Indus. The fort contains the arsenal of the province of Sind and the palace of the Emirs. The principal manufactures are arms, silks, cottons, and lacquered ware. Pop. 75,952.—The district has an area of 9030 sq. miles; the pop. is 990,502.

Hyder Ali, Indian ruler and commander, born in 1728, died in 1782. He was the son of a general in the service of the Rajah of Mysore. By his military talents he became the actual ruler of Mysore, and in 1762 deposed Kandih Rao, and had himself chosen Rajah. He encouraged agriculture and commerce, reorganized the army, and so greatly extended his dominions that in 1766 they contained 84,000 sq. miles, and afforded an immense revenue. In 1780 he formed an alliance with the Mahrattas against the English, took Arcot, but was defeated by Sir Eyre Coote, 1st June, 1781. The Mahrattas now joining in a league against him, he carried on a disadvantageous war, during the continuance of which he died. He was succeeded by his son, Tippoo Sahib.—Cf. L. B. Bowring, *Haider Ali and Tipú Sultan* (Rulers of India Series).

Hydnaceæ, a family of Basidiomycetous Fungi, distinguished by the hymenium being disposed on tooth- or spine-like projections of the fruit-body. The chief genus is Hydnum; *H. repandum* is edible.

Hydra, in Greek mythology, a celebrated monster which infested the neighbourhood of Lake Lerna in the Peloponnesus. Some accounts give it a hundred heads, others fifty, others nine. As soon as one of these heads was cut off, two immediately grew up if the wound was not stopped by fire. It was one of the labours of Heracles to destroy this monster, and this he effected with the assistance of Iolaus, who applied a burning iron to the wounds as soon as one head was cut off. See *Heracles.*

Hydra, an island of Greece, on the east coast of the Morea; length, 11 miles; breadth, about 3 miles. Its surface, though not very elevated (highest point 1939 feet), is almost entirely composed of bare sterile rocks; and the inhabitants, most of whom live in the town of Hydra, on the north-western shore, are engaged in trade and commerce. During the War of Independence the security which the island afforded raised its population for a time to 40,000; and the Hydriotes, with their fleet, played an important part in the struggle. Pop. of island, 7000, almost all concentrated in the town of Hydra.

Hydrangea (hī-dran′jē-a), a genus of shrubs or herbs of the nat. ord. Saxifragaceæ, containing about thirty-three species, natives of Asia and America. The garden hydrangea (*H. hortensis*) is a native of China, and was introduced into Britain by Sir J. Banks in 1790.

Hydrate, a term used in chemistry to denote the crystalline substances obtained by dissolving many substances in water, and then evaporating the water. These crystalline substances have definite physical properties distinct from those of the original substance, and usually a definite crystalline form. The water with which they unite is easily lost, either by exposure to ordinary temperature or by the application of heat. Thus, chlorine gas, if dissolved in water and the solution cooled to 0° C., deposits yellow crystals of chlorine hydrate, $Cl_2 8H_2O$. Anhydrous copper sulphate, $CuSO_4$, if dissolved in water, yields a blue solution, and if the solution be evaporated, blue crystals of hydrated copper sulphate, $CuSO_4 5H_2O$, separate. Many inorganic salts combine with water in this way, and give crystalline hydrates belonging to a different crystalline system, and often of a different colour. Copper sulphate is white, and crystallizes in small needles, whereas hydrated copper sulphate is deep blue, and crystallizes in large tabular crystals belonging to the triclinic system. Cobalt chloride, $CoCl_2$, has a blue tint, but hydrated cobalt chloride, $CoCl_2 \cdot 6H_2O$, is red in colour. Sodium carbonate, Na_2CO_3, is a white powder; hydrated sodium carbonate, washing soda, crystallizes in large transparent crystals, $Na_2CO_3 10H_2O$. These hydrates show the same chemical reactions in solution as the anhydrous salts.

Hydraulic Cement, cement which will set under water and remain, after setting, unaffected by the presence of the water. The term Portland cement is applied to this substance because of the resemblance of the material after setting to Portland stone. It consists essentially of a mixture of about 75 per cent chalk and the remainder clay, ground together to an extreme degree of fineness. The mixture is passed into a rotary kiln, where the temperature is sufficiently high (about 2800° F.) to permit its union and the formation of a clinker, which is afterwards ground to the fineness of flour. The preparation and physical properties of cement are defined in the British Standard Specifications (No. 12; revised, March, 1915), issued by the Engineering Standards Committee.

Certain natural cements possessing the hydraulic property of genuine Portland cement, but of low specific gravity and strength, and of variable character when set, are imported from Belgium. Portland cement is usually tested for tensile strength, both neat cement and cement-sand mixtures, in the form of briquettes, which are broken in special testing machines in which the load can be applied at a steady and definite rate. See *Concrete*; *Reinforced Concrete.*

Hydraul′ic Crane. See *Hydraulics and Hydraulic Machinery.*

Hydraulic Main, a large horizontal pipe, half-full of water, used in a gas-works. The products of distillation are brought from the retorts into the hydraulic main by a ‘ dip-pipe ’ which dips from 1 inch to 3 inches into the water in the main. The more volatile products condense in this main, and are drawn off into the ‘ tar-well ’. See *Gas Manufacture.*

Hydraulic Ram. See *Hydraulics and Hydraulic Machinery*; *Pumps.*

Hydraulics and Hydraulic Machinery. The internal motion in a mass of water may be of two kinds, steady *stream line* motion, in which the motion at a fixed point remains steady and continuous, or else unsteady *eddy* motion, where the motion at any point varies according to no definite law. In steady motion, the stream lines along which the water may be supposed to flow become fixed, as may be shown by the introduction of thin streams of colouring fluid into the mass in motion: the coloured stream line thus formed will appear motionless. If the motion at any time changes to unsteady motion, the coloured line breaks up into multitudinous eddies and is almost instantaneously diffused throughout the liquid. Solid boundaries of a stream of water and the curvature of the path have a great effect in determining the steadiness or otherwise of the flow. Converging boundaries (as in the nozzle of a fire hose) and curving motion with the velocity greatest at the inside of the curve (as in the impact of a steady jet of water on to a plane surface, or the efflux of a jet from a sharp-edged orifice in the wall of a tank) tend to steady motion. Water in motion possesses energy in virtue of its velocity, its pressure, and its height, these giving it kinetic energy, pressure energy, and potential energy. Thus water in motion with velocity v feet per second, pressure p lb. per square foot at height Z feet above some datum has a total energy of $\frac{v^2}{2g} + \frac{p}{w} + Z$ foot-lb. per pound, w being the weight per cubic foot of water.

In stream line motion, where there is no loss of energy due to wall friction or eddy formation, *Bernoulli's Theorem* states that the total energy remains constant, i.e. $\frac{v^2}{2g} + \frac{p}{w} + Z$ is constant from one point to another along a stream line. The use of this equation enables the velocity of efflux from an orifice to be calculated. With a tank containing a small orifice h feet below the surface, the water issues from the orifice in a jet which decreases in section until at a point called the *vena contracta* the jet becomes parallel. The vena contracta occurs (in the case of a small circular orifice) at a distance from the orifice equal to about one-half the diameter of the jet. Comparing the energy of the water at the surface of the tank with the energy of the water in the jet at the vena contracta, at the surface the pressure head and velocity head are both zero if atmospheric pressure is taken as datum, and the potential energy is h taking the level of the orifice as datum, whereas at the jet the potential energy and pressure energy are both zero, and the energy is wholly kinetic. This being so, the kinetic energy at the jet is equal to the potential energy due to height h, that is to say, the velocity of efflux will be the same as if the particles of water had fallen freely through h feet under the action of gravity. That this is so is shown by the fact that a vertical jet of water rises very approximately to the free level in the vessel from which it was supplied.

If the stream lines are curved, the pressure varies from one stream line to another across the stream lines, and the change of pressure may be determined from the fact that it has to be sufficient to balance the centrifugal forces acting on the water which is following a curved path. This change of pressure occurs, therefore, in *vortices*, the pressure increasing from the centre radially outwards; at *sharp-edged orifices*, where the issuing jet has curved boundaries for a short distance before it becomes parallel, and where the pressure is greater than atmospheric within the jet; at the buckets of a *Pelton wheel* (see *Turbines, Water*) where the jet is forced round and back upon itself, the pressure being atmospheric at the inside of the curved jet, while the pressure at the outside surface of the jet serves to force the bucket forward and so drive the wheel.

In practice there is always a loss of total head along a mass of flowing water caused (1) by frictional resistances between the boundaries confining the water, as in flow along a pipe; (2) losses due to formation of eddies which occur when the cross-section of a stream is suddenly enlarged, as when water flows past a gate-valve in a pipe-line, or round a sharp bend in the pipe, in which case a vena contracta is formed on passing the bend, with a subsequent enlargement as the pipe is filled. The losses of head in flow through a pipe-line form an important factor in the problem of determining the minimum size of pipe which shall be capable of discharging a given quantity of water per minute from a reservoir situated at a considerable distance from the power-station or water-works which it supplies. Commencing at the reservoir end of the pipe there is loss of head due to friction and eddy formation at the entrance to the pipe, to friction in the pipe itself, and at valves and sluices, at all elbows and deviations from the straight, at pipe junctions, at sudden changes in area of the pipe, and finally at exit, due to rejection of the kinetic energy of the flow. In each case the losses are approximately proportional to the square of the velocity, so that the total loss of head between entrance and exit of pipe would be Fv^2, F being a factor determined from the particular conditions. Hence if a pipe connects two reservoirs, the difference of head between their free surfaces must be Fv^2 in order that the pipe may run full with velocity v.

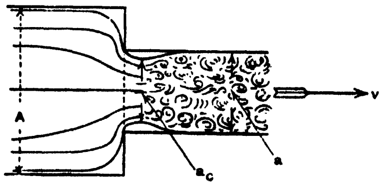


Fig. 1.—Sudden Contraction of Area of Stream

A, Larger stream area. a, Smaller stream area. a_C. vena contracta.

If in fig. 2 a horizontal line AB be drawn through the upper free surface, and if ordinates be drawn vertically downwards from AB representing to scale the total loss of pressure energy per pound of water from the pipe entrance to the particular point considered, the ends of the ordinates will be on a curve called the *hydraulic gradient* for the pipe line. It follows that the pressure energy at all points on the hydraulic gradient is zero, so that the pressure in the pipe at any point will be measured by the vertical distance y_1, y_2, &c., of that point below the gradient. If at any point the pipe line rises above the gradient the pressure becomes less than atmospheric, and any leakage here would allow air to be drawn in, with a possible stoppage of flow. If the pipe rises above the gradient by a distance equal to the barometric height, 34 feet, flow will of necessity stop completely. A *siphon* is an instance where the pipe line rises above the hydraulic gradient.

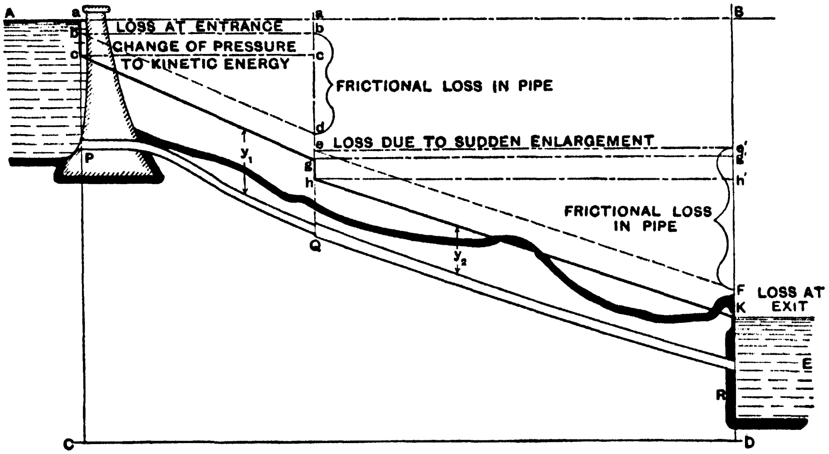


Fig. 2.—Hydraulic Gradient

Hydraulic Machines may be divided into those using (1) *pistons*, giving a reciprocating motion as in cranes, lifts, capstans, &c.; (2) *water-wheels*, used for low heads and low speeds; and (3) *turbines*, suitable for high heads and high speed of rotation, and capable of close speed regulation.

Where pressure water is required, as in towns, for transmission to various hydraulic machines, it may be produced from a steam-engine driving a reciprocating plunger pump by which water taken from a low-pressure supply is forced along suitable mains under pressures varying from 700 to 1600 lb. per square inch in different localities.

Hydraulic Accumulators.—The delivery from a reciprocating pump is not uniform, and it is generally necessary to have some reserve of energy to meet a sudden or abnormal demand, so that pressure energy is often stored by means of an accumulator; this is placed between the pump and the supply main. It consists essentially of a vertical cylinder fitted with a weighted ram, the weight and area of this being adjusted so as to give the required pressure in the mains. The weighting material is usually pig-iron or iron slag. Care must be taken to prevent dangerous inertia shocks, which may occur, due to the great inertia of the heavy moving parts during rapid discharge of water along the mains.

For naval purposes where hydraulic machinery is in general use for training heavy guns and rotating turrets, the accumulator loaded with a mass of iron is obviously inadmissible, and its place is taken by a steam accumulator in which boiler steam is admitted to the upper side of a piston to whose under side the accumulator ram is fixed.

Hydraulic Jigger.—This machine multiplies the motion of a short-stroke hydraulic ram by passing its wire rope round a series of pulleys arranged in two sheaves. The mechanical efficiency of the system is diminished by each multiplication of the stroke, to an extent de-

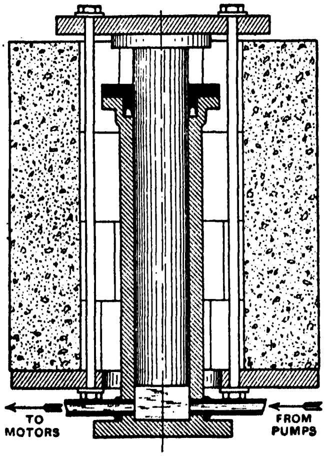


Fig. 3.—Accumulator

pending on the size of the pulleys and size and state of the pulley bearings.

Hydraulic Cranes.—Where high-pressure water is available, the *jigger* forms a very convenient method of operating cranes and has many advantages in safety, adaptability, and steadiness of operation. The various operations of lifting, racking, and slewing, may be performed by separate rams and cylinders. Where the load to be lifted may vary within wide limits, some device is usually adopted to economize water at light loads. For small cranes up to about 2 tons, a telescopic ram may be used, the smaller portion working inside the larger, which itself works in the pressure cylinder. For light loads the larger is held stationary by locking gear, the smaller ram then doing the lifting. For heavy loads the two rams work together as one. Jiggers are used to work cranes, from the small wall crane in a workshop to the 250-ton Goliath cranes used in docks. For work at docks luffing or variable rake cranes are most suitable, whereby parts of the ship at different distances from the crane centre may be reached. The crane may be mounted on a high pedestal, movable on rails in a direction parallel to the dock wall, so that the jib clears all obstructions.

Hydraulic Lifts.—Hydraulic transmission is particularly suitable for use in lifts and hoists, where the motion is intermittent and the speed low. There are several modifications of the simple *direct-acting* or of the *suspended* type. The former consists of a hydraulic cylinder sunk vertically in the ground, of length slightly greater than the maximum travel of the lift, and fitted with a ram which carries the lift cage direct. Pressure water is admitted below the ram and thus raises the cage. The sectional area of the ram must be sufficient to support the load it carries without buckling, and this area is generally so large that the pressure per square inch necessary to raise the load is fairly low, even when an allowance is made for the extra pressure required to overcome friction, and to give an acceleration at starting. For small heights and rough work this type is well suited. For higher lifts, where the weight of ram and cage forms a large proportion of the whole load to be lifted, this weight must be balanced for efficient working. In addition, as the lift rises, the volume of water displaced by the ram diminishes, and so the effective weight of the ram increases. This variation becomes of less importance as the working pressure increases. To overcome these difficulties the ram and cage may be balanced by a weight attached to the cage by chains passing over a series of pulleys at the top of the lift shaft. As the lift rises, the length of chain on the balance weight side of the pulleys increases, and this may be made to balance the increasing effective weight of the ram by making the chain of a weight per foot run equal to half the weight per foot run of the column of water displaced by the ram. This method detracts from the otherwise essential safeness of this type of lift, since a fracture of the ram would cause the cage to run against the top of the shaft. A second device is that of the balance cylinder, in which the weight of the ram and cage may be balanced by a low water pressure produced by forcing water from a separate cylinder into the lift cylinder. The water is forced in by movement of a hollow piston, which may be weighted so as to balance only sufficient of the weight of the cage as to allow the cage to descend with reasonable rapidity on the down stroke, even when the cage is empty. Water from a high-pressure supply may then be admitted into the hollow piston, giving the additional force required to lift the cage and load. The second type of lift—the *suspended* type—is manipulated from a hydraulic ram having a comparatively short stroke. The requisite travel in the wire rope or ropes by which the cage is suspended is obtained by multiplying this by a jigger. The weight of the cage may be balanced by hanging weights, the varying immersion of the ram being unimportant in this case. As the cage of a suspended lift rises, the load on the cage side of the supporting pulley

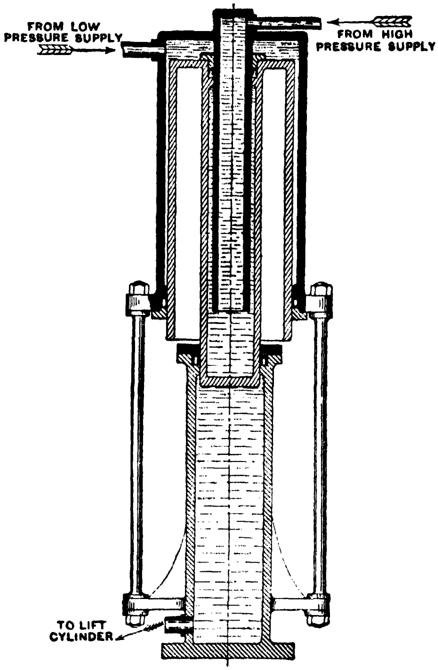


Fig. 4.—Balance Cylinder for Hydraulic Lift

varies with the amount of suspending rope between pulley and cage. This may be counterbalanced by hanging from the under side of the cage a chain the other end of which is attached to a point half-way up the lift shaft. Then at the top of its travel the cage is weighted down by the chain, whilst at the bottom of its travel the chain adds no weight to the cage. The suspension system has certain advantages in virtue of the cheapness of construction of the shorter ram and cylinder, and does not necessitate the provision of a deep well below the lift shaft. Its drawbacks are due to the inefficiency of the multiplying jigger and to the serious effects which may follow the rupture of a wire rope; but adequate safety catches and brakes should render the system quite safe. The speed of hoisting may be as great as convenient, ranging from 2 feet per second for passenger hoists to 6 feet per second for warehouse hoists. In modern American practice speeds of 8 to 10 feet per second are occasionally used for express passenger lifts.

Hydraulic Press.—The many types of hydraulic presses, as used for cotton baling, boiler-plate flanging, cartridge-case drawing, and heavy forging, all use the principle of the *Bramah hydraulic press.* In this press water is forced by means of a small pump, whose plunger has an area a, into the cylinder of the press, whose area is A. Neglecting friction, a force P on the smaller plunger produces a pressure intensity of $\frac{P}{a}$, which is transmitted through the liquid to the press cylinder, giving a force on the press plunger of $\frac{PA}{a}$, which may be made very large if A is large.

The ordinary simple *baling press* consists of a table or bed containing a cylinder and ram, with two or four columns supporting the fixed head. The ram head fits into and forces up the movable table, called the follower, between which and the press head the goods are pressed.

In a machine used for flanging operations, and capable of exerting a force of 420 tons, two small rams may be installed for lifting the head on the up stroke, the pressure for the down stroke being applied by one central and two side rams, pressure water being supplied to these in succession as additional force is required. During the idle part of the down stroke special valves allow water from the exhaust pipe to refill the space vacated by the falling rams. Full pressure only being required, probably, for the last 10 per cent or 20 per cent of the full stroke, one or two of the rams will remain idle for a considerable proportion of the stroke, thus economizing in quantity of pressure water used.

In the production of heavy forgings from large ingots of mild steel, the hydraulic *forging press* is gradually supplanting the steam hammer. With the latter the outer layers of the forging absorb most of the energy of the blows, leaving the interior practically unaffected. The hydraulic press gives a slow and powerful compression which results in a more homogeneous structure, since every part of the ingot is more equally worked. This type of press may be worked with or without a hydraulic accumulator; if without, a low-pressure water-supply at about 200 to 300 lb. per square inch is necessary, and during the idle part of the stroke this follows up the ram, the connecting pipe to a high-pressure pump being kept full in the meantime. When pressure is required the low-pressure supply is cut off and the high-pressure pump is worked, no valves being necessary, as the ram simply follows the motion of the pump plunger. A type of forging press working in connection with an accumulator has the press fitted with a differential ram having diameters of 21 inches and 36 inches and supplied with water at 600 atmospheres. By using each cylinder separately or the two in combination, three powers having the approximate ratio 1 : 2 : 3 may be obtained, with an effective force varying from 1300 tons to 4040 tons. During the working portion of the stroke of a hydraulic press the ram velocity is required to be only very slow, so that the diameters of the supply pipes may be small without appreciable loss of head.

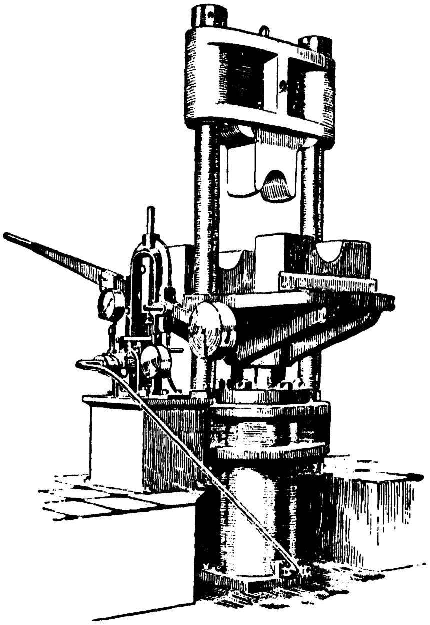


Fig. 5.—Hydraulic Pipe-bending Press

A ratio of ram diameter to pipe diameter of about 12 to 1 is usually adopted.

Water-wheel.—This in general is only suitable for small powers and low heads and where close speed regulation is not essential. Its efficiency is greatly affected by a variation in the supply and in the available head. Its size and weight are great in proportion to the power developed, and the speed of rotation is slow. Three types are used differing in the point of admission of the water. In the *overshot wheel* the water enters near the highest point of the wheel into a series of buckets in the periphery, and drives the wheel by the weight of the falling water. *Breast wheels* are of a similar type, but the water is admitted into the buckets at some point near the level of the wheel axle. For heads of less than 3 feet the *undershot wheel* is used, in which the flowing water impinges on to radial vanes, driving the wheel by giving up the kinetic energy of the moving water. See *Breast Wheel*; *Overshot Wheel*; *Undershot Wheel*; *Turbine*; *Hydro-electric Engineering*.—BIBLIOGRAPHY: A. H. Gibson, *Hydraulics*; F. C. Lea, *Hydraulics*.

Hydrazine, N_2H_4, a substance which was known in the form of its compounds long before the pure substance was isolated. Free hydrazine is difficult to prepare, as the hydrate is stable and is formed whenever the base is liberated in presence of moisture. It was first isolated by Lobry de Bruyn in 1895. It is a colourless fuming liquid boiling at 113° C., and is a strong reducing agent. The salts of the substance and the hydrate are comparatively easily prepared. The hydrate $N_2H_4H_2O$ is a strongly basic substance resembling ammonia, but having reducing properties. Like ammonia, hydrazine forms a series of crystalline salts with acids; for example, hydrazine sulphate, $N_2H_4 \cdot H_2SO_4$, and hydrazine chloride, N_2H_42HCl. In the form of its salts hydrazine is used as a reducing agent, and also as a means of isolating ketones and aldehydes, with which it combines, giving crystalline compounds, the hydrazones. Phenylhydrazine, $C_6H_5NH \cdot NH_2$, the phenyl derivative of hydrazine, reacts readily with certain sugars forming osazones, and by means of these crystalline compounds many of the sugars have been synthesized.

Hy'dride, in chemistry, a compound of hydrogen with any other element, e.g. SiH_4 silicon hydride, Cu_2H_2 cuprous hydride.

Hydrocarbons, the name given to the compounds of carbon with hydrogen. These are exceedingly numerous and are divided into various groups. Each group forms a homologous series where there is an increase of 1 carbon and 2 hydrogen atoms between each member and the succeeding one. Thus, in the paraffin series the first member has formula CH_4, the next member C_2H_6, the next C_3H_8, and so on. Each series exhibits characteristic general reactions which distinguish it from every other series of hydrocarbons. The hydrocarbons are divided first into open-chain compounds such as the paraffins, and closed-chain compounds such as benzene and its derivatives, and the former are further divided into saturated and unsaturated compounds.

The simplest series is the methane series or the paraffins; these have general formula C_nH_{2n+2} (where $n =$ the number of carbon atoms in the molecule). The first member of the series is methane (CH_4), then follow ethane (C_2H_6), propane (C_3H_8), butane (C_4H_{10}), &c. The series is characterized by extreme stability; all the members are saturated, and are not easily attacked by chemical reagents. The first three members are gaseous, then follow a series of liquids, and finally the higher members are solids. Solid paraffins and waxes belong to this series. Of the unsaturated hydrocarbons there is the olefine series, general formula C_nH_{2n}. The first member of the series is ethylene or olefiant gas (C_2H_4). These are colourless substances; the first members are gaseous, then follow liquids, and there is a gradual change in physical properties on ascending the series. A still more unsaturated series of hydrocarbons is the acetylene series, general formula C_nH_{2n-2}. The most important member is acetylene (C_2H_2).

Of the closed-chain compounds there is the benzene series (C_nH_{2n-6}), the first member of which is benzene (C_6H_6); these are stable compounds, and behave as saturated compounds. More complicated hydrocarbons include anthracene, naphthalene, phenanthrene, &c. The hydrocarbons are important industrially as solvents, lubricants, illuminants, and also fuels; they form the starting-point in the manufacture of dyes explosives, and many organic compounds. Many of them occur naturally, e.g. paraffins in petroleum oil-wells; others are produced during the destructive distillation of coal, peat, and bituminous shales. See *Paraffins*; *Benzene*; *Anthracene*; *Naphthalene*; *Organic Chemistry*.

Hydrocele (hī'dro-sēl), a collection of serous fluid in some of the coverings of the testicle or spermatic cord. It is generally the result of an injury or an inflammation of the sac (*tunica vaginalis*) which surrounds the testicle. A large tumour may be formed, filled with fluid, which has often to be drawn off three or four times a year by means of a trocar and cannula. A radical cure may be effected by setting up an inflammation which brings the opposite surfaces of the sac into adhesion, and thus obliterates the cavity.

Hydrocharitaceæ, a nat. ord. of monocotyledonous floating and creeping plants, inhabiting ditches, rivers, and lakes in various parts of the world. The genus Anacharis (*Elodea*) belongs to it. See *Anacharis*.

Hydrochloric Acid, or Hydrogen Chloride (HCl) is a colourless gas, readily soluble in water to a fuming, strongly acid solution. It is formed by the direct combination of its elements, hydrogen and chlorine, but is obtained commercially as a by-product in the manufacture of salt cake (the first stage in the Leblanc soda process) by heating common salt with sulphuric acid, when the following reaction takes place:

$$2NaCl + H_2SO_4 = 2HCl + Na_2SO_4.$$

The hydrochloric acid gas evolved is passed up towers or ‘ scrubbers ’, down which a stream of water trickles and dissolves the gas. The concentrated solution obtained forms the commercial muriatic acid or ‘ spirits of salt ’, which has a specific gravity of 1·16, and contains about 30 per cent of the acid. The crude solution, which is usually of an orange colour, owing to impurities present, is treated with barium sulphide to precipitate arsenic, sulphuric acid, &c. It is then redistilled from glass or lead retorts, with or without the addition of sulphuric acid, a pure solution being thus obtained.

Hydrochloric acid is also made by the action of heat and steam on magnesium chloride, a by-product in the manufacture of potash salts from naturally-occurring deposits. The acid reacts with most metals, hydrogen being liberated and the chloride of the metal formed. With oxidizing agents such as nitric acid, manganese dioxide, &c., chlorine is produced.

Hydrochloric acid is largely used for cleaning iron before it is tinned or galvanized, and also for many other purposes in the arts and manufactures.

The series of salts, the chlorides, derived from hydrochloric acid are widely distributed, and are, with the exception of silver, lead, and mercurous chlorides, readily soluble crystalline salts. Sodium chloride, or common salt, is the most important member of this class, being present in sea-water to the extent of nearly 3 per cent. It is the substance from which practically all the chlorine and chlorine-containing compounds of commerce are obtained. It is used as a preservative for food, and in small quantities is necessary for the maintenance of health in animals living on a vegetable diet. When taken internally in large quantities, it acts as an emetic. It is the main saline constituent of blood, and for this reason it is used for intravenous injections in the case of persons suffering from loss of blood. Externally it is used in the form of salt baths for the treatment of rheumatism and sciatica.

Hydrochloric Ether. See *Ethyl* (*chloride*).

Hydrocyanic Acid, or Prussic Acid (HCN), occurs in nature in the glucoside amygdalin, which is present in bitter almonds. A solution of the acid may be obtained by distilling potassium cyanide or ferrocyanide with dilute sulphuric acid. The pure substance is prepared by dehydrating the aqueous solution with calcium chloride. Hydrocyanic acid is a colourless mobile liquid which boils at 26° C., solidifies in the cold, and then melts at −14° C. It possesses a penetrating acrid smell, which in very weak solution only is suggestive of bitter almonds. It is excessively poisonous, a single drop taken internally causing instantaneous death, due to paralysis of the heart. Smaller doses cause pain in the head, giddiness, and nausea, accompanied by paralysis of the respiratory organs and of the spinal cord. In cases of poisoning, emetics should be given at once, followed by injections of ether or alcohol; artificial respiration should also be resorted to.

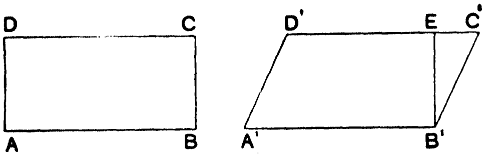
Hydrocyanic acid forms, with metallic bases, a series of salts, cyanides, which have an alkaline reaction and are also poisonous. See *Cyanides*.

Hydrodictyon, a genus of freshwater Green Algæ, group Protococcales. *H. utriculatum*, the water-net, is one of the most elegant of Algæ. The full-grown plant consists of a bright green hollow sac, about 6 inches in length, composed of a delicate meshwork of narrow cylindrical cells. Reproduction is ordinarily by zoöspores, which are formed in large numbers in any cell of the thallus; they never leave the mother-cell, but soon arrange themselves to form a tiny daughter-net, which after a time is set free and ultimately grows to the full size. This remarkable plant is found in Britain, but is local.

Hydrodynam′ics is that part of the science of dynamics which deals with fluids. It is the science of the motion of fluids in relation to the forces acting upon them. Just as the term dynamics has a wider and a more restricted sense according as it is taken to include statics as well as kinetics, or to be identical with the latter, so the term hydrodynamics in its wider sense includes hydrostatics as well as hydrokinetics. The present article excludes the consideration of hydrostatics (q.v.). The mathematical theory of hydrodynamics strictly applies to imaginary ideal fluids, which have such simple and exactly defined properties as to make mathematical treatment possible. These ideal fluids differ in important respects from the fluids of nature. Thus the ideal fluid of hydrodynamics is perfectly continuous, and any portion which is bounded by a geometrical closed surface remains continually bounded by that surface in all its subsequent motion, the surface changing in form but never losing its continuity. Actual fluids are molecular in structure, and continual interdiffusion goes on between contiguous portions. But in spite of this difference between the ideal and the actual, in many cases the behaviour of the latter is sufficiently closely represented by the calculable behaviour of the former. The ideal fluid is defined to be a body which has no elasticity of shape, but perfect elasticity of bulk, or, in an important special case, is incompressible. No actual fluid is incompressible, but actual liquids have small compressibility. Actual gases are represented by the 'compressible fluid' of the mathematical theory.

There is a cross-classification of fluids into *viscous* and *non-viscous* or *perfect* fluids. Viscosity is mathematically specified as follows.

Let ABCD be the cross-section of a rectangular prismatic portion of a fluid which has 'parallel flow' in the direction AB, those particles having equal velocities which are at the same distance from the face of which AB is the section. Let A′B′C′D′ be the cross-section of the same fluid prism after one second has elapsed, the motion being such that A′B′C′D′ is a parallelogram having A′B′ = AB and B′E = BC, where B′E is the perpendicular let fall from B′ upon D′C′. Thus in one second a shearing strain whose measure is EC′/B′E (which we may denote by *s*) has been developed. The accompanying shear stress across AB or any plane parallel to AB may be denoted by *f*. Then μ, 'the coefficient of viscosity', is measured by f/s. In words, μ is 'the shear stress per unit of shear strain developed per second'. Its value in an actual fluid depends on the nature of the fluid and on its temperature. The theoretical 'perfect fluid' of hydrodynamics has $\mu = 0$, i.e. it has the same property when in motion which all fluids have at rest, of being unable to exert any but a *normal* force across any interface or upon any bounding surface.



The following are commonly adopted notations for quantities entering into hydrodynamic calculations:

x, *y*, *z* are the rectangular co-ordinates of a point P of the fluid; ρ is the density, μ the viscosity, and *p* the pressure of the fluid at P; *u*, *v*, *w* are the velocity-components of the fluid at P, and *q* the resultant velocity; X, Y, Z are the components of the force per unit mass acting on the body of the fluid in the neighbourhood of P.

Certain equations are established which form a sort of book-keeping method for the quantities involved. First, there is the 'mass-account'. This is given by the 'equation of continuity', which expresses the condition that any change of mass of fluid occupying a given element of space must be accounted for by the flow of fluid across the geometrical bounding surfaces of the element. In its differential form it is written

$$\frac{d\rho}{dt}+\frac{d.\rho u}{dx}+\frac{d.\rho v}{dy}+\frac{d.\rho w}{dz}=0.$$

The elementary equivalent in the case of flow of an incompressible fluid in a pipe is $Av =$ constant, where A is the area of any cross-section, and *v* the average velocity of the liquid across that section. Next, the 'momentum account', applying Newton's Second Law of Motion, expresses the condition that the time-rate of increase of momentum of the fluid in any element of space is equivalent to the resultant of the forces (including both thrusts on its bounding surface, and body-forces which act throughout its mass) acting on the fluid in that element, together with the excess of the momentum of fluid entering the element in unit time over that of the fluid leaving the element. In its differential form the 'momentum-account' is expressed by the 'equations of fluid motion' due to L. Euler, viz.

$$\frac{du}{dt}+u\frac{du}{dx}+v\frac{du}{dy}+w\frac{du}{dz}=X-\frac{1}{\rho}\frac{dp}{dx},$$

with two other similar equations for the components parallel to the axes OY and OZ.

Instead of reckoning up the momentum-account for the contents of a given element of space, we may apply the reckoning to a given portion of fluid as it flows, and so arrive at another form of the differential equations of motion, also given by Euler, but usually named after Lagrange, who investigated them at a later date. The Lagrangian equations are not often used. They involve derivatives of the second order.

The 'energy-account' applies the condition that the rate of increase of the energy in any portion of fluid is equal to the rate at which work is being done upon it. The energy-equation is deducible from the equations of motion, and, for the case of an incompressible fluid, may be written in the form

$$\tfrac{1}{2}\rho\frac{Dq^2}{Dt}=-\left(u\frac{dp}{dx}+v\frac{dp}{dy}+w\frac{dp}{dz}\right)$$
$$+\rho(Xu+Yv+Zw).$$

Here the symbol $\frac{D}{Dt}$ refers to time-rate of increase, not at a fixed point in space, but following the motion of the fluid. In the most important case, when the body-forces have a potential Ω which is independent of t, so that $X = -\frac{d\Omega}{dx}$, &c., the equation reduces to

$$\tfrac{1}{2}\rho\frac{Dq^2}{Dt} = -\rho\frac{D\Omega}{Dt} - \left(u\frac{dp}{dx} + v\frac{dp}{dy} + w\frac{dp}{dz}\right).$$

From this, by integration over a given region, we get

$$\frac{D}{Dt}(T + V) = -\iiint\left(u\frac{dp}{dx} + v\frac{dp}{dy} + w\frac{dp}{dz}\right)dxdydz,$$

where

$$T = \tfrac{1}{2}\iiint\rho q^2 dxdydz, \quad V = \iiint\rho\Omega dxdydz,$$

T being the kinetic energy, and V the potential energy of the fluid within that region.

A *line of flow* is a line drawn in the fluid so that the direction of the flow at any point is that of the tangent to the line. A *stream-line* is the actual path of a particle of the fluid.

In an important class of cases a function ϕ exists (the *velocity potential*), such that

$$u = -\frac{d\phi}{dx}, \quad v = -\frac{d\phi}{dy}, \quad w = -\frac{d\phi}{dz},$$

and it can be shown that if the body-forces have a potential, and if ρ is constant or a function of p only, then a portion of a fluid having a velocity-potential at any instant will continue to possess a velocity-potential ever afterwards. Where ϕ exists, the lines of flow are everywhere perpendicular to the surfaces for which ϕ is constant. In this case Euler's Equations of Motion can be integrated, giving the result

$$\int\frac{dp}{\rho} = \frac{d\phi}{dt} - \Omega - \tfrac{1}{2}q^2 + F(t),$$

where $F(t)$ is an arbitrary function of t. In *steady motion* i.e. motion in which the velocity at a given point of space is independent of the time, this reduces to

$$\int\frac{dp}{\rho} + \Omega + \tfrac{1}{2}q^2 = \text{constant} \qquad \text{(Bernoulli's Theorem).}$$

The *constant* in the present case, in which the motion is *irrotational* (see below), has the same value throughout the fluid. But it can be shown that Bernoulli's Theorem is true in *rotational* motion also, the constant keeping the same value along any one stream-line, but varying from one stream-line to another. When gravity is the only body-force acting, $\Omega = gz$, where z is the height above a fixed datum-level. In this special case Bernoulli's Theorem may be written

$$\int\frac{dp}{g\rho} + z + \frac{q^2}{2g} = \text{constant.}$$

This equation has important applications in hydraulics, and is expressed in words as follows: 'The sum of the pressure-head, the height above datum-level and the velocity-head, is constant along a stream-line'. It includes Torricelli's Theorem that the velocity of a jet of water issuing from an orifice in a vessel containing a liquid having a free surface practically at rest, is the same as that which would be acquired by a body falling freely from the level of the free surface to that of the orifice. It is applicable to explain the theory of the 'Venturi water-meter'.

Rotational and Irrotational Motion.—If a small spherical portion of a fluid were suddenly to become solidified, it would in general have rotation about an axis. This is 'molecular rotation' or 'vortex motion'. If the 'molecular rotation' at every point of a portion of fluid is zero, its motion is said to be 'irrotational'. The components of molecular rotation with reference to the axes of co-ordinates are:

$$\xi = \tfrac{1}{2}\left(\frac{dw}{dy} - \frac{dv}{dz}\right), \quad \eta = \tfrac{1}{2}\left(\frac{du}{dz} - \frac{dw}{dx}\right),$$
$$\zeta = \tfrac{1}{2}\left(\frac{dv}{dx} - \frac{du}{dy}\right).$$

If $\xi = \eta = \zeta = 0$, then $udx + vdy + wdz$ is an exact differential, and its integral $\int(udx + vdy + wdz)$ along any line in the fluid is called the 'flow' along that line, and is the same for all co-terminous lines which are 'reconcilable', i.e. which can be made to coincide by continuous deformation in the fluid. If the end points of the path coincide, it becomes a circuit, and the value of $\int(udx + vdy + wdz)$ taken round the circuit is called the 'circulation' of the circuit. It is zero for every circuit in irrotational motion, provided the fluid is 'simply-connected'.

In rotational motion lines can be drawn which at every point have the same direction as the axis of molecular rotation at that point. Such lines are 'vortex-filaments', and they must either form closed circuits or extend to a boundary of the fluid. Helmholtz proved that a vortex-filament persists, and is always composed of the same fluid particles, though it may change in form. He also proved that in a perfect fluid vortex motion can neither be generated nor destroyed. This property suggested to Lord Kelvin his vortex-ring theory of atoms. A tube of fluid consisting of the vortex-filaments passing through any closed circuit is called a vortex-tube. The 'circulation' round any circuit on the surface of the tube is a constant if the circuit encloses the tube, and is zero if it does not enclose it, but is 'reconcilable' to a point.

The calculation of fluid motions which are rotational is difficult, and has been effected only in the simpler cases, e.g. in two-dimensional motion. The very simple case of a fluid rotating like a rigid body reduces to a problem of hydrostatics, by the artifice of assuming it at rest under 'centrifugal force'. A fluid may have rotational motion without 'molecular rotation', as in the so-called 'free vortex' of hydraulics.

The presence of a fluid increases the effective inertia of a solid body in motion. The amount of the increase has been calculated for a few bodies, such as spheres and ellipsoids. For a sphere moving in an infinite liquid, the effective inertia exceeds the actual inertia by exactly one-half of the mass of the fluid displaced by the sphere.

For the applications of hydrodynamics to problems in hydromechanics, such as flow of water in pipes, and the action of water-wheels and turbines, see *Hydraulics and Hydraulic Machinery*; *Turbine, Water*. See also *Tides*; *Waves*.—BIBLIOGRAPHY: H. Lamb, *Hydrodynamics*; A. B. Bassett, *Elementary Treatise on Hydrodynamics and Sound.*

Hydro-electric Engineering, the science of generating electricity by the use of water-power. Water is capable of doing mechanical work in falling to a lower altitude. The maximum mechanical work 1 pound of water can do is h foot-pounds where h is the vertical height through which the pound of water falls. If 33,000 pounds of water fell through a height h in every minute, then the work done per minute would be 33,000 h, i.e. the rate of doing work would be h horse-power. This output of energy cannot be all turned into electrical energy; some of it is unavoidably wasted in the processes of transformation. The usual practical process is this: a lake is found in a mountain range on which there is a heavy waterfall. All the outlets of the lake but one or two are dammed, so that all the rain falling on the hills and running into the lake must leave it through the openings left for the purpose. If the lake is, say, 3000 feet above the level of the surrounding country, the water in falling to the lower country will drop through 3000 feet and do 3000 foot-pounds of work per pound. Very large pipes are joined to the lake outlets and carried downwards to the lower level, where turbines are placed. The course of these pipes is kept as straight and as vertical as possible. This reduces the losses of energy in pipe friction. On reaching the lower level the water is passed through water-turbines, which absorb about 85 per cent of the energy in the falling water. After passing through the turbines, the water runs away by a large canal-like duct called a 'tail race', whence it is led to a river or the sea and discharged. The turbines are usually coupled to alternating current three-phase electric generators (q.v.). These machines generate electrical energy at a moderate voltage, say 3000 volts. The electrical energy is led from the generators to a bank (group) of transformers, where the pressure of the electricity is changed from 3000 volts in-coming to about 100,000 out-going if the electricity is used in a distant town. The high-tension terminals of the transformers (q.v.) are connected to the transmission-line, which usually consists of six or more copper or aluminium conductors hung on steel towers. This line crosses the country from the electric power-station, which may be, and probably is, in a mountainous region away from large cities, to the industrial districts where the electrical energy is used. The 'receiving-end' of the line, i.e. the town end of it, as it were, enters a transformer house, where a bank of transformers again converts the energy from 100,000 volts to the distribution voltage required. Usually a double transformation takes place here, from, say, 100,000 to 3000 volts, and again from 3000 volts down to a lower voltage for general distribution purposes. The over-all efficiency of such a system is about 70 per cent. See *Turbine, Water*; *Power Transmission*.—Cf. A. H. Gibson, *Hydro-electric Engineering.*

Hydro-extractor, a machine used in washing, milling, dyeing, bleaching, and finishing departments of the textile industry, as well as in laundries and other places where it is desired quickly to expel the bulk of moisture from yarns, fabrics, and the like. The machine consists of two concentric drums or cylinders, one within the other, open at the top, and having the inner cylinder perforated in some way so that the expelled liquid may escape and be conducted to an outlet pipe. The outer drum forms a substantial and fixed support, while the inner drum rotates, when desired, at a high velocity about a vertical shaft suitably journalled in the base of the outer drum or foundation, and in the curved bridge-piece of the upper part of the outer drum. The rapid motion of the inner drum generates sufficient centrifugal force to cause the cloth or yarn to be pressed against the inner circumference or side of the drum, and to expel thereby the bulk of the liquid with which the goods were originally saturated; the liquid then escapes as already indicated. As the inner drum rotates, the liquid flies tangentially from the goods through the perforations in much the same way as it does from a mop when the latter is trundled to dry it more or less. In both cases a certain amount of moisture remains; indeed, in many instances it is not desired to expel all the moisture, and in no case is the material perfectly dry.

Hydrofluor'ic Acid, or **Hydrogen Fluoride** (HF), a colourless gas of very pungent odour which fumes in contact with air. On the skin it produces blisters, it chars organic substances such as paper or wood, attacks glass rapidly, and is a very poisonous substance. If cooled down, the gas may be liquefied, and pure anhydrous hydrofluoric acid, which is difficult to prepare owing to its great corrosive action and its affinity for moisture, is a colourless liquid which boils at 19° C. Hydrofluoric acid is soluble in water, yielding a strongly acid solution which fumes in air and attacks glass, &c., just as the gas does. On this account commercial hydrofluoric acid is stored in wax-lined bottles or gutta-percha bottles, as it has little action on these substances. The solution and the gas are employed in glass-works to mark graduated apparatus. The glass to be etched is coated with a thin layer of wax, and the design traced with a fine-pointed instrument; after etching by exposing to hydrofluoric acid gas or solution, the wax is dissolved away, and the design becomes visible wherever the acid has come in contact with the glass. It is also used in mineral analysis for the decomposition of silicates. Hydrofluoric acid is manufactured from calcium fluoride and concentrated sulphuric acid in cast-iron cylinders. The acid is condensed in spiral lead condensers, and collected in lead receivers.

Hydrogen, chemical symbol H, atomic weight 1·008, the lightest of all the elements. It occurs free in the atmosphere of the sun, and in small quantity in volcanic gases and the gases issuing from oil-wells. In the combined state it is very abundant. Water contains one-ninth part by weight of hydrogen. It is an essential constituent of all acids, and is present in all vegetable and animal organic matter. Pure hydrogen is a colourless, tasteless, odourless gas, very slightly soluble in water. It is a non-supporter of combustion, but is itself combustible, burning in air or oxygen with production of water. The flame of hydrogen is almost non-luminous and is intensely hot. The densities of gases are usually stated relative to the density of hydrogen taken as unity. Hydrogen long defied liquefaction, but after liquid air could be obtained in quantity, Dewar succeeded in liquefying the gas by compressing it to 180 atmospheres and cooling with liquid air. Liquid hydrogen is colourless, and boils at −252° C. By rapid evaporation of the liquid, hydrogen may be obtained as an ice-like solid. Hydrogen combines with some elements directly. Thus, hydrogen and oxygen combine explosively to form water if 1 volume of oxygen and 2 volumes of hydrogen are brought together in a confined space and a light is applied. Hydrogen and fluorine combine to form hydrofluoric acid, HF, on merely mixing the elements. Hydrogen and chlorine combine immediately if mixed and exposed to bright sunlight. Other elements unite with hydrogen by the aid of a catalyst, or indirectly. Nitrogen and hydrogen form ammonia, NH_3. Carbon and hydrogen form acetylene, C_2H_2, or other hydrocarbons.

Hydrogen is usually prepared in the laboratory by the action of dilute acids, hydrochloric acid or sulphuric acid, on metals such as zinc or iron. The metal displaces hydrogen, forming a salt and liberating the gas. Thus the action of zinc on sulphuric acid is represented by the equation $Zn + H_2SO_4 = ZnSO_4 + H_2$. Hydrogen may also be prepared by electrolysis of water, by the action of steam on red-hot iron, and by the decomposition of some metallic hydrides by means of water. On account of the intense heat of the oxyhydrogen flame, attaining a temperature of 2800° C., it is used in autogenous welding in steelworks, and for fusing substances of high melting-point such as quartz and platinum. It is produced in quantity for use in aeronautics; for hardening oils; as a reducing agent in the manufacture of organic substances such as aniline and naphthylamine; and as a fuel, usually as water-gas.

Hydrogen Peroxide, H_2O_2, is a compound of oxygen and hydrogen much richer in oxygen than water, H_2O. It is usually met with in aqueous solution, termed 10 or 20 volumes peroxide, according to the number of volumes of oxygen evolved when one volume of the solution is decomposed. In the pure form it is a syrupy liquid with a specific gravity 1·45, and in this state it is extremely unstable. When the solution is heated, oxygen is evolved and water is formed. The readiness with which the peroxide gives up half its oxygen renders it a valuable oxidizing agent. Thus it is used to restore the brilliancy of oil paintings which have become discoloured. This discoloration is generally due to the formation of black lead sulphide, and the peroxide transforms this into white lead sulphate, $PbSO_4$. It is also used as a bleaching agent, and is a powerful antiseptic. It is usually prepared by the action of dilute sulphuric acid on hydrated barium peroxide, $BaO_2, 8H_2O$; or in small quantities by decomposing sodium peroxide with dilute hydrochloric acid at low temperatures.

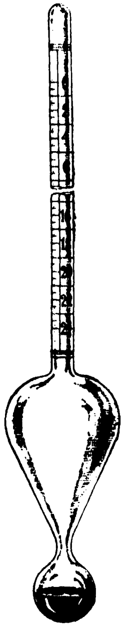
Hydrogen Sulphide, or **Sulphuretted Hydrogen,** sometimes termed hydrosulphuric acid, H_2S, is a colourless inflammable gas occurring in volcanic gases, and in certain mineral springs, the springs at Harrogate, for instance. It is produced during the putrefaction of sulphurous organic matter, and when organic matter containing sulphur is destructively distilled. Crude coal-gas contains sulphuretted hydrogen, produced from the sulphur present in coal. It is usually prepared by the action of dilute hydrochloric acid on iron sulphide. It has a sweet taste, but a very nauseating odour resembling that of rotten eggs. It is poisonous when inhaled, and experiments have shown that birds died in air which contained $\frac{1}{1000}$th part of the gas. It is a strong reducing agent, and is largely used in laboratory analysis, as almost all the metals form sulphides with it. The sulphides or salts of sulphuretted hydrogen are nearly all insoluble in water, and many have characteristic colours. Thus, antimony sulphide is bright orange when precipitated, arsenic sulphide is canary yellow, and copper sulphide is brownish-black.

Hydrography is the science which deals with the surface waters of the globe: oceans, seas, lakes, rivers, and underground waters. It includes the study of their distribution, composition, and physical properties, the study of tides, currents, the flow of rivers, and problems of water-supply, as well as the precise survey and charting of waters for the purpose of navigation. Hydrography overlaps the physical aspects of oceanography (q.v.), but is not concerned with the floor of the oceans, the origin of ocean basins, or the flora and fauna of the waters. In a narrower sense hydrography is sometimes confined to the study of rivers, lakes, and underground waters, but there is no common agreement as to the scope of the subject. The hydrographic survey of a sea or lake entails numerous observations at many stations, the position of which must be accurately determined. In addition to ascertaining the depth it is necessary to take the temperature, specific gravity, and salinity of the water at the surface, bottom, and intermediate depths, as well as the direction of flow of the currents. Temperature and current observations must be made on the spot, but determinations of specific gravity and salinity can be done on shore if a sample of the water is secured and kept without contamination. It is desirable that similar observations should be taken periodically at the same stations in order that seasonal changes may be noted. By these means the circulation of the waters can be determined. Information of that nature, together with biological researches on the food and habits of fishes and other marine animals, have great practical importance in relation to food production. Principally with this end in view the International Commission for the Scientific Investigation of the North Sea was established in 1899, the participating countries being Great Britain, Germany, Holland, Belgium, Russia, Denmark, Sweden, and Norway. Many marine biological laboratories in European and American coasts undertake periodical hydrographical work in waters adjacent to them. Most notable are the stations at Bergen and Plymouth, and the Musée Oceanographique at Monaco. Temperature observations are taken either by reversing thermometers or insulated water-bottles lowered to the desired depth. Salinity is expressed in the total weight of salts in a given weight of water. Its total range of variation being only from 33 to 37 per 1000, extreme accuracy in salinity determinations is essential, since by the salinity of a water sample it is often possible to trace its movement and thus throw light on marine circulation. The various salts occur in practically constant proportions, so that the determination of one salt gives the salinity and specific gravity. Conversely, by the determination of specific gravity the salinity can be reached. Specific gravity is found by either the total-immersion hydrometer or the electrolytic conductivity of the water, to determine which no sample need be brought on board, the electrodes being lowered to the required depth. Salinity can also be ascertained by precipitating the chlorides with silver nitrate. The content of gases in water is determined by boiling the water and collecting the gases, or else by titration. Accurate current observation is one of the most difficult tasks in hydrographical research. Various forms of current meter (q.v.) are used, but they necessitate the vessel being anchored, and in rough water the accuracy of their results is doubtful. Recent research has revealed the existence of great vortex movements in ocean waters, and their investigation offers peculiar difficulties. Hydrographic survey is carried out by soundings, with either the lead-line or sounding-wire. In shallow and much-frequented waters, such as natural harbours and their approaches, detailed work is essential, but sounding should be supplemented by the use of wire drags. A wire rope is stretched at a depth of about 30 feet between two vessels steaming on parallel courses 500 to 1000 feet apart. The method effectively locates any pinnacle rocks that would imperil navigation. Photohydrography, or the photography of the sea-floor from aeroplanes, has been tried without much success as far as charting is concerned. The rise and fall of the tides is ascertained by the use of tide gauges, which are either self-registering or simple graduated poles which must be read at intervals.

Charts of all known coasts of the world are published by the British Admiralty (Hydrographic Department) on scales dependent on the amount of traffic, the difficulties of navigation, and the state of knowledge. These are continually revised as fresh information comes to hand. The United States Coast and Geodetic Survey and the United States Hydrographic Office publish charts of United States coasts, and of the great lakes, and also some of Mexico and Central America. France, Germany, Holland, Norway, and some other nations also publish official charts of certain coastal waters. The principal sea-powers of the world have survey vessels continually at work checking, verifying, and extending coastal surveys, but few coasts outside Europe, the Indian Empire, the United States, and Japan are yet completely charted.

The hydrography of rivers and lakes is of growing importance as increase of population makes greater demands on the water resources of a country. In addition to the survey of the river and the calculation of its catchment area it is necessary to know the rate and volume of flow at all seasons of the year. For this purpose gauging stations are established. Analysis of water samples shows the content of dissolved and suspended matter, considerations of importance in the utilization of the water. Many countries are now paying close attention to the use of water as a source of power. The study of water resources is also important in relation to the navigability of rivers and lakes and the water-supply available for canals. In arid countries like Australia the investigation of underground water available for irrigation and wells is vital to the settlement of the land. In some countries the regulation of rivers and lakes has received much attention. From early times there have been gauges on the Nile; the regulation and distribution of its water is the chief problem in Egyptian administration. The Danube and the principal German rivers have been exhaustively studied. Several Russian and Siberian rivers have been charted in detail. The Rhône and the Seine are among the French rivers that have received most attention. The survey of the Scottish inland lochs and the principal English lakes has been made by private enterprise. In the United States and Canada there are State departments charged with the study of the water resources of the country. See *Deep-sea Exploration.* — BIBLIOGRAPHY: Wharton, *Hydrographical Surveying*; Sir John Murray and J. Hjort, *The Depths of the Ocean*; Russell, *River Development*; Sir John Murray, *Bathymetrical Survey of the Fresh Water Lochs of Scotland*; J. C. Hoyt and N. C. Grover, *River Discharge*; Helland-Hansen, *The Norwegian Sea*; publications of Dominion of Canada Water Power Branch, United States Coast and Geodetic Survey, United States Geological Survey (Water Power Branch), International North Sea Commission, and various deep-sea and Antarctic expeditions.

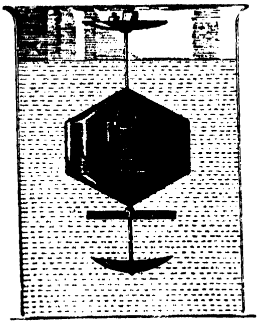
Hydrom′eter, an instrument for measuring the densities of liquids; one type, the Nicholson hydrometer, is also employed to measure the densities of solids. The hydrometer of variable immersion is usually made of glass, and consists of a hollow closed tube which is expanded into two bulbs at the lower end. The tube contains a graduated scale, and the lower, smaller bulb is loaded with mercury or lead shot so that the hydrometer may float in a vertical position. By Archimedes' principle, the weight of a floating body is equal to the weight of liquid which the body displaces. Thus the hydrometer will float high in a heavy liquid, but will sink more deeply in a light liquid, the volume of the immersed portion being inversely proportional to the density of the liquid. The scale is so graduated that the density of the liquid is given by the scale reading which coincides with the surface of the liquid. This form of hydrometer is sometimes used as a lactometer for testing the density of milk; another is employed by revenue officers to test the alcoholic content of liquors; whilst another form is useful, in the care of storage batteries, to indicate by the density of the acid the state of the cells during charging and discharging. The Nicholson hydrometer is termed one of constant immersion, since it is always adjusted by added weights to float so that a given mark on the stem is level with the surface of the liquid in which the instrument is immersed. If the added weight W_0 is known, the instrument can be used to determine the densities of solids and liquids. Let a solid



Twaddel's Hydrometer

To find the specific gravity, multiply reading by 5, add 1000, divide by 1000, e.g. for reading 24, 24 × 5 = 120. Specific gravity = 1·120.

of weight less than W_0 be placed on the top pan, and a weight W_1 added to sink the hydrometer in water to the mark on the stem. Then $W_0 - W_1$ is the weight of the solid. If the solid is now transferred to the lower pan, and immersed in water, the weight W_2 required to adjust the instrument as before will be greater than W_1, and $W_2 - W_1$ measures the weight of water displaced by the solid. Hence the density of the solid is given by the ratio of $W_0 - W_1$ to $W_2 - W_1$. This holds whether the solid is lighter or heavier than water. If W is the weight of the hydrometer itself, then $W + W_0$ measures the weight of water which the instrument displaces when floating at its normal depth. If, on being placed in another liquid, it is sunk to the mark by adding a weight W^1 to the top pan, then $W + W^1$ is the weight of this liquid displaced by the hydrometer. The density of the second liquid is found from the ratio of $W + W^1$ to $W + W_0$. All forms of these instruments are subject to inaccuracy caused by the action of surface tension.



Nicholson's Hydrometer devised by Professor Muir

Hydrop'athy, a method of treating diseases by the use of pure water both internally and externally, which has come extensively into practice. The system was known several centuries before the Christian era, and was advocated by the ancient Greek master of medicine Hippocrates, and adopted by many of his Greek, Roman, and Arabic-speaking followers; but in modern times it was revived by Vincenz Priessnitz, a Silesian peasant, who in 1829 established at his native village of Gräfenberg an institution for the hydropathic treatment of diseases, and invented a variety of forms in which the water cure might be applied, such as the wet-sheet pack, the dry blanket or sweating pack, the sitz, douche, plunge, wave, &c., baths. The new system soon acquired popularity, and the original establishment expanded into an extensive suite of buildings. Other hydropathic institutions soon sprang up in other parts of Germany. In 1842 a Hydropathic Society was formed in London, and ere long numerous establishments were erected all over the United Kingdom. Before Priessnitz's death in 1851 he had the satisfaction of seeing his system adopted extensively throughout Europe, as well as in the United States of America, where it was introduced in 1843. In many cases there can be no doubt of patients having received great and lasting benefit by a sojourn at a hydropathic institution, and the free use of water in its various forms of appliance; but it may well be doubted whether these advantageous results are not as much to be attributed to the ablutions, exercise, and diet to which in such circumstances the patients readily submit themselves as to the wet bandages, douches, and other forms of hydropathic treatment. Apart from the full regime of a hydropathic institution, water has come to play a large part in the treatment of disease, not merely for administration by the mouth or for the washing of the alimentary canal, but also in the form of baths, wet-packs, fomentations, douches, sprays, &c., administered in hospital or at home.

Hydropho'bia (Gr. *hydōr*, water, and *phobos*, fear), a specific disease, technically known as *rabies*, arising from the bite of a rabid animal. The animals most liable to be afflicted with the disease are dogs; but cats, wolves, foxes, &c., are also subject to it. The early symptoms of rabies in the dog are such as restlessness and general uneasiness, irritability, sullenness, an inclination for indigestible and unnatural food, and often a propensity to lap its own urine. As the disease proceeds the eyes become red, bright, and fierce, with some degree of strabismus or squinting; twitchings occur round the eye, and gradually spread over the whole face. After the second day the dog usually begins to lose perfect control over the voluntary muscles. He catches at his food, and either bolts it almost unchewed, or, in the attempt to chew it, suffers it to drop from his mouth. This want of power over the muscles of the jaw, tongue, and throat increases until the lower jaw becomes dependent, the tongue protrudes from the mouth, and is of a dark, and almost black colour. A peculiar kind of delirium also comes on, and the animal snaps at imaginary objects. His thirst is excessive, although there is occasionally a want of power to lap. His desire to do mischief depends much on his previous disposition and habits. He utters also a peculiar howl, and his bark is altogether dissimilar from his usual tone. In the latter stages of the disease a viscid saliva flows from his mouth, and his breathing is attended with a harsh, grating sound. The loss of power over the voluntary muscles extends, after the third day, throughout his whole frame; he staggers in his gait, and frequently falls. On the fourth or fifth day of the disease the dog dies, sometimes in convulsions, but more frequently without a struggle. In regard to man the rabid virus seems to be more violent when it proceeds from wolves than from dogs. It appears to be contained solely in the saliva of the animal, and does not produce any effect on the healthy skin. But if the skin is deprived of the epidermis, or if the virus is applied to a wound, the inoculation will take effect. The development of the rabid symptoms is rarely immediate; it seldom takes place before the fortieth or after the sixtieth day, but in some cases has occurred after six months or even longer. It begins with a slight pain in the scar of the bite, sometimes attended with a chill; the pain extends and reaches the base of the breast if the bite was on the lower limbs, or the throat if on the upper extremities. The patient becomes dejected, morose, and taciturn. He prefers solitude, and avoids bright light; frightful dreams disturb his sleep; the eyes become brilliant; pains in the neck and throat ensue. These symptoms precede the rabid symptoms two or three days. They are followed by a general shuddering at the approach of any liquid or smooth body, attended with a sensation of oppression, deep sighs, and convulsive starts, in which the muscular strength is much increased. A foamy, viscid slaver is discharged from the mouth; the deglutition of solid matters is difficult; the respiration hard; the skin warm, burning, and afterwards covered with sweat; the pulse strong; the fit is often followed by a syncope; the fits return at first every few hours, than at shorter intervals, and death takes place generally on the second or third day. No means have yet been found of arresting the progress of the poisonous virus after it has once developed in the system. The treatment, therefore, consists in preventing its development, which may be effected by applying a ligature, where possible, to impede the circulation from the wound, by sucking it, and thoroughly cauterizing it either with nitrate of silver or with iron heated to a white heat, the pain of cautery being less as the temperature is greater. If these means are not available, any burning substance and most acids may be used. After being bitten by a dog suffering from rabies it is of vital importance not only to treat the wound locally in the way suggested, but to subject the patient as soon as possible to the Pasteur treatment to counteract the development of the virus. M. Pasteur put forward a method of preventing the development of the disease by a system of successive inoculations with rabid virus of greater and greater intensity; the inoculation being made the first day with marrow which has been extracted from the rabid animal 12, 10, and 8 days; then the second day with marrow extracted 6, 4, and 2 days; the third day with one day's marrow, &c. About 15 per cent of the people bitten by rabid dogs contract hydrophobia. In cases not treated by the Pasteur method death is practically certain.—BIBLIOGRAPHY: *Annales de l'Institut Pasteur* (1887–8); F. Karslake, *Rabies and Hydrophobia.*

Hydrophyllaceæ, or **Hydroleaceæ,** a natural order of gamopetalous Dicotyledons, allied to Polemoniaceæ, mainly North American herbs. It includes several favourite hardy annuals, such as the species of Nemophila and Phacelia.

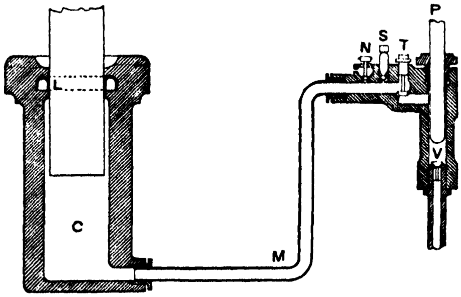
Hydropterideæ, or **Water-ferns,** a collective name frequently employed for the Marsiliaceæ and Salviniaceæ, two families of Leptosporangiate Ferns, which agree in being heterosporous and aquatic, but otherwise are not closely related.

Hydroquinone, or **Para-dihydroxy-benzene** ($C_6H_4(OH)_2$), is prepared by the oxidation of aniline with an ice-cold mixture of potassium or sodium bichromate and sulphuric acid, followed by the reduction of the product (benzoquinone) with sulphur dioxide. The mixture is then filtered and the hydroquinone extracted with ether. It forms colourless crystals, having a slightly sweet taste, melting at 169° C., and is readily soluble in alcohol, ether, and hot water. Chemically, it acts as a reducing agent, and is used under the name of quinol in photographic developers. Alone, it gives extremely strong, rather hard negatives of a bluish-black tone, but in conjunction with metol excellent results are obtained.

Hydrostat′ics is the statics of fluids. A fluid (q.v.) is a body which, when its parts are relatively at rest, can only exert a normal thrust upon any surface with which it is in contact, or across any ideal surface separating contiguous portions of it. In other words, a fluid at rest cannot support the least shearing stress. It has no 'elasticity of shape', but its 'elasticity of bulk' is perfect. All fluids, however viscous, conform practically perfectly to this definition —hence the theorems of hydrostatics apply to real fluids with a mathematical exactness which is almost unique in theoretical physics. The whole theory of the equilibrium of fluids is deduced from a few fundamental postulates, viz. the laws of statics, and the defining property of a fluid which has just been stated.

Intensity of fluid pressure at a point.—Suppose a small plane surface to pass through a point P in a fluid at rest. The portions of the fluid separated by this surface exert on each other equal and opposite forces at right angles to the surface. If F be the measure of one of these forces, and A that of the area of the surface, then F/A is the average pressure across the surface, and the limiting value of this when A tends to zero is 'the pressure at P in the direction perpendicular to the surface'. It can be proved that the pressure at a point is the same in all directions, hence it is unnecessary to specify direction when pressure at a point is spoken of.

Pascal's Principle, or 'the principle of transmissibility of fluid pressure', asserts that if the pressure at any point of a fluid in equilibrium is increased, then to maintain equilibrium the pressure at every other point of the fluid must rise by the same amount. This principle (like all others in hydrostatics) is deducible mathematically from the definition of a fluid. It is the basis of the theory of the Bramah Press. In a heavy fluid at rest the surfaces of equal pressure are horizontal, and hence the free surface of a liquid is horizontal. If the difference of level between two points in a continuous mass of fluid at rest is h feet, and the fluid has a uniform density of w pounds per cubic foot, then the pressure at the lower point exceeds that at the upper point by wh pounds per square foot.



Bramah or Hydraulic Press

V, Inlet valve. P, Pump plunger. T, Pump outlet valve. S, Safety valve. N, Outlet for water. C, Press cylinder. L, Press ram.

Thus the pressure at a depth of 10 feet below the surface of still water is about 623 pounds per square foot greater than the atmospheric pressure at the surface. At a depth of 34 feet the pressure is double the ordinary atmospheric pressure. On account of the greater density of mercury, the same pressure is got at a depth of about 30 inches or 760 millimetres in mercury. In the ordinary mercurial barometer the pressure inside the tube above the mercury is practically zero, so that the difference between the level of the free surface within the tube and that which is exposed to the atmosphere gives an accurate measure of the atmospheric pressure. In hydraulics the pressure is often expressed as a 'head of water' of so many feet. The rule for calculating the total pressure on an immersed surface is that the average pressure per unit area of the surface is exactly the pressure at the geometrical 'centre of gravity' of the surface. Thus if a vertical plane rectangle is immersed so that h is the depth of its middle point, the average pressure upon it is wh, where w is the weight per unit volume, and the total pressure is whA, where A is the area of the surface. But though the resultant thrust is whA, its line of action does not meet the surface at its centre of gravity but lower down, at a point called the 'centre of pressure'. The depth of the centre of pressure of any immersed plane surface is got by dividing the second moment of the plane area about the line in which its plane cuts the surface of zero pressure, by the first moment of the area about the same line. For example, if the vertical rectangle has one side in the surface of zero pressure, the depth of the centre of pressure is two-thirds of the depth of the rectangle.

The Principle of Archimedes is of the utmost importance for problems on the equilibrium of floating bodies, and, more generally, for the discussion of pressures on immersed bodies. Its precise statement is as follows: "The resultant of the fluid pressures on a wholly or partially immersed body is equal to the weight of the 'fluid displaced' and acts vertically upwards in a line through the 'centre of buoyancy'."

The 'fluid displaced' is that which would exactly fill the cavity left if the immersed body were removed. The 'centre of buoyancy' is the centre of gravity of the 'fluid displaced'. The upward force is called the buoyancy. Applying this principle to a wholly immersed body heavier than the fluid, and supported by a fine cord, the problem is reduced to that of a body acted on by three forces—the weight W of the body, the buoyancy W′, and the pull P of the cord. The two former being vertical, the third (and therefore the cord) must be vertical also. Further, $P + W' = W$. Hence $P = W - W'$. P is the 'apparent weight', and we see that it is less than the true weight by the amount of the buoyancy. This difference between apparent and real weights is the basis of many methods of determining specific gravity. An experiment on the same principle can be employed to determine the density of the fluid if that of the immersed body is known (see *Hydrometer*). The apparent weight of a body in air is usually taken as the real weight, but air, though light, has weight, and a body in air is acted on by a 'buoyancy' equal to the weight of air displaced. In exact weighings this must be taken into account if the density of the body differs much from that of the counterpoise weights used. Applying Archimedes' Principle to the case of a freely floating body, we find that it will displace an amount of the fluid equal in weight to itself.

The pressure of a fluid without weight would be the same at all points. For many practical purposes we may treat air and gases as having no weight, and therefore having the same pressure throughout, but in the case of the atmosphere, the weight is of importance. The density, like the pressure, decreases as we go upwards. To calculate the pressure p at a height x above the sea-level, we proceed as follows. Let w denote the weight of air per unit volume, at height x. We have $dp = -wdx = -(w_0p/p_0)dx$, by Boyle's Law, where w_0 and p_0 are the values of w and p at sea-level. Hence $dp/p = -(w_0/p_0)dx$, and, by integration, $\log_e p - \log_e p_0 = -w_0x/p_0$, or $x = (p_0/w_0)(\log_e p_0 - \log_e p)$. This formula gives the relation between x and p on the supposition that p is proportional to w, which will be the case if the temperature is uniform. If the temperature varies, a correction must be made. The formula is the basis of *hypsometry*, the science of determining heights by barometric observations. If H denotes the depth of a fluid of uniform density w_0 which would give a pressure p_0, then $w_0\mathrm{H} = p_0$, and H is called 'the height of the homogeneous atmosphere'. Its value depends only on the temperature. For the temperature 0° C., H (in feet) is about 26200, so that if x be expressed in feet, we have $x = 26200(\log_e p_0 - \log_e p)$. See *Heights, Measurement of.*

Stability of Equilibrium of Floating Bodies.—A body is said to be in *stable* or *unstable* equilibrium according as it tends to return to or recede from the position of equilibrium when slightly displaced from it. If the body is in equilibrium also in its slightly displaced position, the equilibrium is *neutral.* Now, in the case of a completely immersed floating body, such as a submerged submarine, we have only two forces acting, the weight of the vessel acting vertically downward at G, its centre of gravity, and the 'buoyancy' acting vertically upward at B, the centre of buoyancy. For equilibrium the buoyancy must equal the weight, and BG must be vertical. For angular displacements about a horizontal axis the equilibrium will be stable or unstable, according as B is above or below G. For displacements not involving such angular motion the equilibrium is neutral. In the case of a vessel floating partly immersed, the conditions for stability are different. For vertical displacements the equilibrium is stable, but for horizontal displacements and for rotation about a vertical axis it is neutral. For rotational displacement about a horizontal axis the equilibrium is stable, unstable, or neutral, according as the centre of gravity of the vessel is below, above, or at a point called the *metacentre* (q.v.). The laws of hydrostatics apply to gases as well as to liquids (see *Gases, Properties of*).

Though hydrostatics in the first place applies to fluids at rest, its principles can be applied also to fluids in motion, provided that the whole of the fluid moves like a rigid body, and provided we assume fictitious forces acting on its particles, equal and opposite to those that would be required to impart to them their actual accelerations. Thus if a fluid rotates like a rigid body about a vertical axis, the 'centrifugal force' on each particle must be taken into account. At the free surface, for example, the resultant of centrifugal force and of the earth's attraction (weight) must be normal to the surface. From this can be deduced that the free surface in this case is a paraboloid of revolution whose axis is the axis of rotation.

The effects of capillarity (q.v.) are in apparent contradiction with the laws of hydrostatics; the free surface, for example, is not a horizontal plane. But Laplace showed that these effects may be explained by the existence of forces of attraction between contiguous particles of the liquid, so that, taking such attractions into account, the free surface is always at right angles to the resultant force on the particle.

Illustrations of the principles of hydrostatics will be found in the articles on *Hydraulics and Hydraulic Machinery*; *Archimedes*; *Barometer*; *Capillarity*; *Diving-bell*; *Hydrometer*; *Specific Gravity*.—BIBLIOGRAPHY: A. G. Greenhill, *Hydrostatics*; J. Greaves, *Elementary Hydrostatics*; R. H. Pinkerton, *Hydrostatics and Pneumatics*.

Hydrothor'ax, a dropsical condition of the pleura, in which the pleural cavity contains a serous fluid exuded from the blood-vessels, not due to inflammation. It may be the result of organic disease in the heart or kidneys, or of pressure on vessels obstructing the return of blood.

Hydrotropism. See *Chemotropism.*

Hydrozo'a, a class of animals forming a subdivision of the phylum Cœlenterata, and including the hydroid zoophytes, many of the smaller jelly-fishes (*medusæ*), a few corals, and certain extinct forms. They are nearly all marine, but perhaps the most familiar example is the little freshwater polype (Hydra), which has a tubular body not more than an inch long when fully extended, closed at one end (foot), and with an aperture (mouth) at the other. A number of slender radiating tentacles are present near the mouth, and these catch the food, which largely consists of minute crustacea. The body-wall is made up of two cellular layers, an external *ectoderm,* and an internal *endoderm* bounding the digestive cavity. Between the two is a structureless membrane (*mesoglœa*). The ectoderm, especially that of the tentacles, is provided with numerous stinging-cells (*nematocysts*), from which poisoned threads can be shot out to paralyse the active prey. Reproduction is by budding (*gemmation*) during spring and summer, but sex-cells are produced in swellings of the ectoderm in autumn. The fertilized egg-cells develop into minute embryos which, enclosed in horny coats, remain dormant in the mud until the following spring.

Hydroid zoophytes are branching colonies of hydra-like individuals united by a common body (*cœnosarc*), and covered by a horny skeleton. Some of these, such as Obelia, give rise to sexual buds, which become detached and swim away as little jelly-fishes (*medusæ*). The fertilized eggs of these develop into new fixed colonies. A life-history of this kind, where asexual and sexual stages alternate, is a good example of alternation of generations. The medusa may be compared to an umbrella with a short handle (*manubrium*), at the end of which the mouth is situated. Owing to development of the mesoglœa the umbrella is somewhat thickened, and its margin is fringed with tentacles and provided with eye-spots or special sense-organs concerned with the maintenance of equilibrium. The mouth opens into a digestive cavity that traverses the manubrium and then expands into a sort of stomach, from which narrow canals radiate to the edge of the umbrella, where they join a circular ring canal. Swimming is effected by opening and shutting of the umbrella.

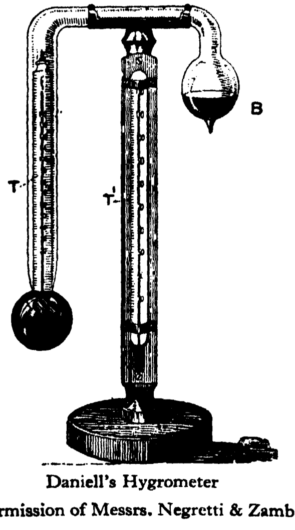
The following nine orders of Hydrozoa are distinguished: (1) Eleutheroblastea, including only the aberrant and almost cosmopolitan Hydra, of which three species are common in this country, the brown hydras (*H. vulgaris* and *H. oligactis*), and the green hydra (*H. viridis*). The colour of the last is due to the presence of minute Algæ in the endoderm, and this is a good example of *symbiosis*, where two organisms are intimately associated to the benefit of both. (2) Milleporina. Massive corals, millepores, which produce numerous simple medusæ. (3) Gymnoblastea - Anthomedusæ. The individual members of the colonial fixed stage are not sheltered in horny cups, and the sex-cells of the medusæ are developed in the manubrium. Sense-organs, eye-spots. The medusa stage may be reduced and not free-swimming. Examples: Podocoryne and Hydractinia (the fixed stage lives on shells inhabited by hermit-crabs, a case of commensalism); Tubularia, Coryne, Clava, Corymorpha, Pelagohydra (the asexual stage is free-swimming, and consists of a single individual). (4) Calyptoblastea-Leptomedusæ. Members of the colonial stage protected in cups, and the sex-cells of the medusæ developed on the floors of the radial canals. Eye-spots or balancing sense-organs. This stage often reduced as in (3). Examples: Sertularia, Hydrallmania, Plumularia, Campanularia, Obelia. (5) Graptolitoidea. Extinct forms, somewhat resembling hydroid zoophytes, and characteristic of the older Palæozoic rocks. (6) Stylasterina. Branching corals without a free-swimming medusa stage. (7) Trachomedusæ and (8) Narcomedusæ include forms in which the asexual stage is reduced and ceding groups; (7) includes the interesting freshwater medusæ Limnocodium (in *Victoria regia* tanks) and Limnocnida (lakes Tanganyika and Victoria Nyanza). (9) Siphonophora. Free-swimming colonies (see special article).

Hyères (ē-är), a town of Southern France, department of Var, 10 miles east of Toulon, beautifully situated on a declivity facing the Mediterranean. It is much frequented by patients suffering from chest or nervous disorders. Pop. 9400.

Hygieia (hī-ji-ē′ya), the Greek goddess of health, daughter of Asclepius, or Æsculapius. Her temple was placed near that of Æsculapius, and her statues were even erected in it. She is represented as a youthful maiden with a bowl in her hand, from which she is feeding a snake, the symbol of healing. In 293 B.C. her cult was introduced into Rome, where she was known as *Valetudo*, or *Salus*.

Hygiene. See *Dietetics*; *Food and Food Values*; *Public Health.*

Hygrom′eter, an instrument for measuring the amount of aqueous vapour in the air. Certain materials, such as catgut and hair, alter in length as the result of absorbing moisture from the air, and hygroscopes are made in which this property is employed. The toy Swiss chalet from which the figure of a man emerges in wet weather, and of a woman in fine weather, depends on the untwisting of a piece of catgut when it absorbs moisture, and is a rough and often tardy indi-

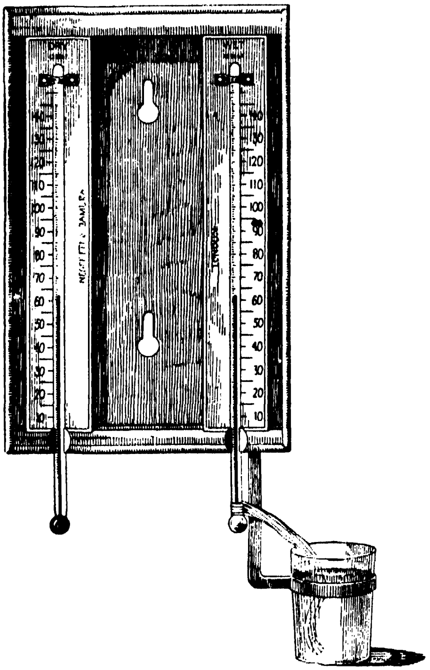


Daniell's Hygrometer

By permission of Messrs. Negretti & Zambra.

A, Bulb two-thirds filled with sulphuric ether at beginning of experiment, when bulb B is empty. T′, Thermometer registering temperature of air. T, Thermometer whose bulb is immersed in ether of bulb A.

instrument the changes in length of a hair cause a pointer to move over a scale and to indicate empirically the hygrometric state of the atmosphere. In one form of hygrometer the aqueous vapour is absorbed from the air by passing a measured volume of air through tubes which contain a drying agent such as calcium chloride, phosphorus pentoxide, or pumice stone steeped in vitriol. The increase in weight of the tubes is found, and the number of grammes of water vapour present per unit of volume measures the absolute humidity of the air. The fraction of saturation is found by dividing the result by the weight of vapour which a unit of volume *could* contain at the same temperature. In another class of instrument the air is cooled artificially until the contained vapour condenses on the instrument. The temperature at which this takes place is noted as the dew-point. By means of tables the maximum vapour pressures at the dew-point and at the temperature of the air are found, and their ratio gives the relative humidity or fraction of saturation. Hygrometers of the above type have been devised by Daniell, Regnault, and Dines. In the Regnault hygrometer the cooling is caused by the evaporation of sulphuric ether. A thermometer is placed within a closed thin silvered metal bulb which contains sufficient ether to cover the bulb of the thermometer. Air is then blown in by a tube, and bubbles up through the ether, thus causing evaporation and cooling. The mixture of air and ether vapour escapes by another tube. The air surrounding the bulb is gradually cooled, and, by observing the thermometer and the lower end of the bulb through a telescope, the temperature is noted at which dew begins to appear. The air-current is stopped and the apparatus allowed to warm up. When the dew begins to disappear, the temperature is again noted, and the mean of the two temperatures is taken as the dew-point. Daniell's hygrometer is used in a similar way. The bulb A is partly filled with ether, the bulb B and the tube connecting it with A containing at first only ether vapour. A muslin cloth moistened with ether is wrapped round B, and causes ether vapour to condense in B. The resulting evaporation from A into the tube cools A, on which dew condenses. The dew-point is then determined as with Regnault's instrument. In the third type, known as the wet-and-dry-bulb hygrometer, there are two equal similar thermometers; the bulb of one of these is covered with thin muslin, which dips into a small dish of water and keeps the bulb wet. The cooling caused by evaporation causes the wet bulb to fall in temperature, and the lowering of temperature will depend on the dryness of the air. The dew-point lies in general below the temperature of the wet bulb, and is calculated from the observed difference of temperatures. In the simplest method of calculation the difference of temperature between the two bulbs is multiplied by a factor taken from a table of Glaisher's factors; on subtracting the result from the temperature of the dry bulb, the dew-point is obtained. The fraction of saturation can then be found as before. Greater accuracy is obtained by using a form of this instrument called the sling psychrometer, which can be whirled round by hand, thus ventilating the wet bulb more thoroughly. The dew-point is then calculated by means of a formula such as Apjohn's, or that of Ferrel, which is used by the United States Weather Bureau.



Standard Hygrometer

By permission of Messrs. Negretti & Zambra.

Hygrophytes, terrestrial plants which require abundant water-supply and a moist atmosphere, such as the shade-plants of tropical forests. The opposite of Xerophytes (q.v.).

Hyksos, or **Hycsos,** or Shepherd Kings, wandering tribes of Semitic descent, who conquered the whole of Egypt about 2100 B.C., and were driven out some five hundred years afterwards. The only detailed account of them in any ancient writer is a passage of a lost work of Manetho, cited by Josephus (*Kata Apionos*, i, 14). Manetho adds that " they are said to have been Phœnicians or Arabs ". The Hycsos are therefore considered as nomadic Semites, either Arabs or Canaanites, but some historians suppose them to have been Turanians. Their epoch covers the thirteenth to the seventeenth dynasties.—Cf. J. H. Breasted, *A History of the Ancient Egyptians.*

Hylæosau′rus, a fossil reptile discovered in the Wealden formation of Tilgate Forest. Its probable length was about 25 feet. It is one of the Dinosauria, and, like many of that group, presents a structure intermediate between that of existing birds and reptiles.

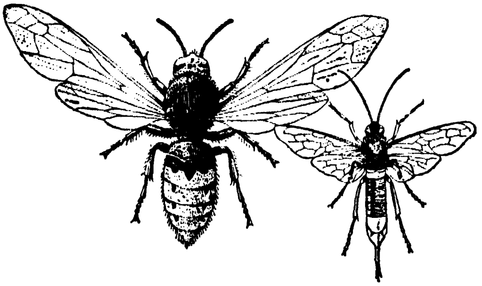
Hy′men, or **Hymenæ′us**, originally the Greek name of the marriage song; later the god of marriage in Grecian mythology. No marriage took place without his being invoked to sanction it. He is described as having around his brows the flowers of marjoram, in his left hand the flame-coloured nuptial veil, in his right the nuptial torch, and on his feet golden sandals. He is a taller and more serious Eros, and is accompanied by song and dance. He is represented as the son of Apollo and a muse, or less often as the son of Dionysus and Aphrodite.

Hymenium, in botany, a term applied in the Higher Fungi to a continuous layer of asci or basidia, such as is characteristic, for example, of Discomycetes and the majority of Basidiomycetes.

Hymenomycetes, a collective name for the higher groups of Basidiomycetous Fungi, from the Hydnaceæ upwards, but excluding the Gastromycetes.

Hymenophyllaceæ. See *Filmy Ferns.*

Hymenop′tera (Gr. *hymēn*, a membrane, and *pteron*, a wing), an extensive order of insects, comprising bees, wasps, ants, ichneumon-flies, gall-flies, saw-flies, and allied insects. They are characterized by four membranous naked wings which have comparatively few veins. The second pair of wings is always smaller than the first. The mouth parts are provided with biting jaws and a suctorial organ. The head is freely movable, and besides the lateral compound eyes there are usually three ocelli on the top of the head. The Hymenoptera undergo complete metamorphosis. Females have the extremity of the abdomen furnished either with an ovipositor, forming a boring organ (*terebra*), or a sting (*aculeus*). Hence the two sub-orders into which Hymenoptera are divided: Terebrantia, comprising the saw-flies, gall-flies, ichneumon-flies, &c., and the Aculeāta, which include the bees, wasps, ants, hornets, &c.



Hymenoptera

Hornet (*Vespa crabro*), one of the Aculeāta, on left. *Sirex gigas*, one of the Terebrantia, on right. Hornet two-thirds natural size. Sirex half natural size.

Hymet′tus, a mountain in Attica, now called *Trello Vouni*, south-east of Athens, distinguished among the ancients for the excellence of its marble and its honey. The latter is still in repute.

Hymn of Hate, a piece of doggerel German verse, first published in the Munich *Jugend* under the title of *Hassgesang gegen England.* Its author was a very minor poet named Ernst Lissauer, who was a converted Jew serving in the Prussian army. At the time of its publication Germany was filled with hatred for the British on account of their entering the war and depriving Germany of her overseas possessions. The song therefore became immensely popular in Germany, was sung and recited everywhere, and even found its way into school-books and anthologies. Lissauer was fittingly rewarded by the bestowal of the Iron Cross.—Cf. I. Zangwill, *The War for the World.*

Hymns and Hymn-writers. An article on hymns should deal with the liturgical poems of all nations and creeds. In our short space, however, we must confine ourselves to Christian hymnody and to the part of it which is in use in this country. Here again we can only notice in passing the non-metrical parts of our liturgies, such as the *Psalms* and New Testament canticles, and the two non-Biblical prose poems the *Te Deum* and *Gloria in Excelsis.* In the narrower sense of metrical religious songs our hymnody has its roots in the Latin Church, and may be said to date from the fourth century and mainly from Ambrose, the great Bishop of Milan, and Prudentius, the first really Christian poet. Of hymns by the former perhaps the best known is *Splendor paternæ gloriæ* (O Jesu, Lord of heavenly grace), while to the latter belongs the fine Christmas hymn *Corde natus* (Of the Father's love begotten). Amongst the most famous of later Latin hymns that are now in common use are *Vexilla regis prodeunt* (The royal banners forward go) by Venantius Fortunatus (sixth century), the two beginning *Pange, lingua* (Sing, my tongue, the glorious battle) and (Now, my tongue, the mystery telling), the first in honour of the cross and perhaps by the last-named author, the other eucharistic and by the great schoolman Thomas Aquinas (thirteenth century). To him also we owe another famous eucharistic hymn, *Adoro te devote* (Thee we adore, O hidden Saviour). To these we may add the wonderful *Dies iræ* (Day of wrath! O day of mourning), which is generally ascribed to the follower and biographer of St. Francis, Thomas of Celano (thirteenth century), and *Veni Creator Spiritus* (Come, Holy Ghost, Creator, come), which in a rather loose translation has the unique honour of appearing in our prayer-books, and has been ascribed amongst other claimants to Charlemagne himself. Perhaps also with these should rank the *Stabat Mater Dolorosa* (At the cross her station keeping), dating perhaps from the twelfth century.

In *Hymns Ancient and Modern* about 20 to 25 per cent of the hymns are from the Latin, but it must not be supposed that all are ancient or mediæval. For instance, the popular *Adeste fideles* (O come, all ye faithful) is probably of the seventeenth or eighteenth century. Our hymn-books also owe something to German hymnody, as, for instance, *Nun danket alle Gott* (Now thank we all our God) and the harvest hymn *Wir pflügen und wir streuen* (We plough the fields, and scatter), but this element is small compared with the Latin, while the contributions of other nations are smaller still. It may be observed that it is in connection largely with festivals and special occasions that the Latin and other foreign hymns have taken deepest root. On Easter Day the hymns most often heard in church are all wholly or partially of foreign origin. When we turn to native hymnody, the first main fact to observe is that in the reformed Churches metrical versions of the *Psalms* and other parts of the Scriptures for long held sway. But the versions of Sternhold and Hopkins, followed by that of Tate and Brady, have little attraction for the present generation, and only a few such renderings as the *Old Hundredth* are in common use. Even the older and in some ways more beautiful versions of the *23rd Psalm* have given way to *The King of Love my Shepherd is* of Sir Henry Baker, which is rather a meditation than a paraphrase. The Scottish version indeed far longer retained its hold in its own home, and is not displaced yet. Paraphrases of other parts of the Bible have still less currency. A remarkable exception is *When shepherds watched their flocks by night*, due to Tate himself.

Hymns are essentially for the people, and their permanent value must be judged by the hold they gain over the religious emotions rather than by the critical standards we usually apply to poetry. Judged on this principle, the sixteenth and seventeenth centuries produced little that has stood the test. The most remarkable specimen of the sixteenth century is the *Jerusalem, my happy home* of F.B.P. (Francis Baker, Priest?), which in various forms is common enough, though its real charm lies in the quaint verses which are rarely found in modern collections. The name of George Wither (seventeenth century), who published a hymn-book of his own, should not be omitted, but little or nothing of his appeals to modern taste. In the same century Henry Vaughan's (the 'Silurist') *My soul there is a country* is sometimes used, but neither he nor the greatest of our religious poets, George Herbert, have somehow been able to touch that particular chord in the heart which the hymn appeals to. So, too, Herrick's *Sweet spirit, comfort me* has sometimes been placed in modern collections, but has probably been rarely sung. The chief names of the seventeenth century are those of the great Nonconformist Richard Baxter, whose *Lord, it belongs not to our care* and *Ye holy angels bright* are deservedly well known, but not of first-rate popularity, and Thomas Ken, one of the 'Seven Bishops', whose *Awake, my soul* and *Glory to Thee, my God, this night* used to be known respectively as *the* Morning and *the* Evening hymn.

It is with the opening of the eighteenth century that the Golden Age of English hymnody begins. The first name is perhaps the greatest —that of Isaac Watts. There are probably in every collection more hymns by him than by any other author, unless it be Charles Wesley, and many of them have a very high place in the affections of hymn-lovers. First, perhaps, stand two which appeal to very different emotions, *When I survey the wondrous cross* and *O God, our help in ages past*, though there are many others which are general favourites. Charles Wesley, who was some thirty years younger than Watts, is said to have composed 6000 hymns, of which 500 are in use. It would be difficult to say which are either the best or the best known. Perhaps, on the whole, the palm should go to *Jesus, Lover of my soul* and *Lo! He comes with clouds descending*, and, above all, *Hark! the herald angels sing*. Though the first line and some others of the last-mentioned hymn are attempts to improve on Wesley, the whole is substantially his. And though no doubt it is largely the associations of Christmas and Mendelssohn's tune that give it its position, the fact remains that it is the most popular of English hymns.

Toplady (born 1740), though he wrote other hymns of merit, will always be known by one —*Rock of Ages*—the last verse of which, like the first of *Lo! He comes*, reaches a level of simple sublimity which gives it a high place in English poetry. William Cowper is perhaps the only great English poet who is also a great hymn-writer. In the latter capacity he is closely associated with his friend John Newton, in conjunction with whom he published the *Olney*

Hymns. While Newton is best remembered by *How sweet the name of Jesus sounds*, Cowper gave us such famous hymns as *God moves in a mysterious way* and *Hark, my soul! it is the Lord*, and, above all, *There is a fountain filled with blood*, a poem which, though its images often repel, has had a vast influence on some forms of religious feeling.

When we come to the nineteenth century, probably most people would give the first place to John Keble. His *Christian Year* does not contain a single hymn in the proper sense of the word, but much material from which hymns may be drawn. The most obvious examples are his *New every morning* and *Sun of my soul*, taken from his morning and evening meditations. Bishop Heber's *From Greenland's icy mountains* is supreme as a missionary hymn. Two hymns written during the first half of this century are of extraordinary popularity, and at the same time raise interesting questions as to what are the qualities which make a great hymn. These two are Cardinal Newman's *Lead, kindly Light* and H. F. Lyte's *Abide with me*. Both are generally treated as evening hymns, but really describe thoughts and feelings alien to the minds of those who use them. Lyte's is a meditation on the close of life, Newman's on religious doubts and difficulties. Yet after all we may be glad that they are what they are in popular estimation.

Amongst the chief writers of this period or a little later we may perhaps place Horatius Bonar, the author of *Thy will, not mine, O Lord* and *A few more years shall roll*. Sarah Adams's *Nearer to Thee* is perhaps not so popular as it was, and it is remarkable that it drew down the scorn of a great poet and critic, Matthew Arnold, who took the lines *Out of my stony griefs, Bethel I'll raise* as an example of the worst doggerel. It may be here noted that this is the first time we have had to mention the name of a woman writer, and probably there are few of the front rank. Mrs. Alexander, the authoress of *The roseate hues* and *There is a green hill far away*, may perhaps be regarded as holding the first place among English woman hymnodists.

Whether the last fifty or sixty years have produced many great hymns, it is too early to judge. To the writer it seems that few which he did not know in childhood have really established themselves, and if he would make an exception, it would be in favour of Baring-Gould's *On the resurrection morning!* One thing it is necessary to say in conclusion. The number of hymns now in circulation is immense, and the list of hymn-writers and translators in the Index to Julian's *Dictionary of Hymnology* reaches to something like 4000 names. Such a selection as has been here made must needs be largely a reflection of personal tastes, coloured by early associations, and is not therefore likely to be universally satisfactory.—BIBLIOGRAPHY: J. E. Prescott, *Christian Hymns and Hymn-writers*; W. T. Stead, *Hymns that have Helped*; Duncan Campbell, *Hymns and Hymn-makers*; L. F. Benson, *Studies of Familiar Hymns*; S. A. W. Duffield, *English Hymns: their Authors and History*; J. Julian, *Dictionary of Hymnology*.

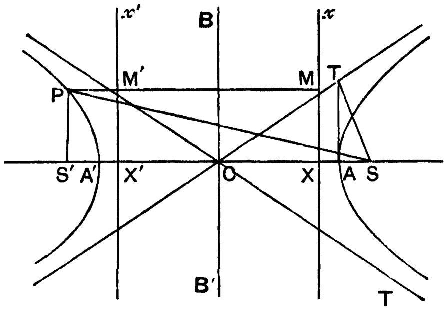
Hyndman, Henry Mayers, British economist and socialist leader, born in London 7th March, 1842, died 22nd Nov., 1921. Educated at Trinity College, Cambridge, he started as a journalist, and acted as correspondent for the *Pall Mall Gazette* during the Austro-Italian War in 1866, where he became the friend of Mazzini, Garibaldi, and other Italian patriots. Between 1869 and 1871 he travelled in America, Australasia, and Polynesia, became an adherent of the socialistic theories of Marx, and founded the Social Democratic Federation in 1881. An active agitator for social reforms, he was tried at the Old Bailey in 1887 in connection with riots in London, but was acquitted. He unsuccessfully contested Burnley in 1895, 1906, and 1910. Hyndman was a vigorous agitator against the Boer War (1899–1902), but supported the British Government in their attitude during the European War. His works include: *Indian Policy and English Justice* (1874); *England for All* (1881); *Historical Basis of Socialism* (1883); *Economics of Socialism* (1896); *The Future of Democracy* (1915); *The Awakening of Asia* (1919); *Clemenceau: the Man and his Time* (1919); and *The Evolution of Revolution* (1920).

Hyoid Bone, in anatomy, a bone shaped somewhat like the letter U, but with a wide bend and shorter limbs in proportion to the body, and having a pair of upward projections or lesser *cornua* (horns), the horizontal limbs of the U being called the *greater cornua*. It is suspended horizontally in the substance of the soft parts of the neck between the root of the tongue and the larynx (Adam's apple). See *Larynx*.

Hyoscyamine ($C_{17}H_{23}NO_3$), an alkaloid isomeric with atropine, and occurring with it in several plants, e.g. Deadly Nightshade (*Atropa Belladonna*), Thorn Apple (*Datura Stramonium*), and in henbane (Hyoscyamus). It is extracted from the mother-liquor in the preparation of atropine, as it is more soluble in water and in alcohol than atropine. It crystallizes in minute silky needles of melting-point 108·5° C., and is lævorotatory, whereas atropine is inactive. Hyoscyamine is a strong poison. It is used medicinally in the form of its salts, and is given internally and subcutaneously. It dilates the pupil of the eye, and is used by oculists for the same purpose as atropine.

Hypa'tia, a Greek woman, a philosopher of the eclectic school, the daughter of Theon, a celebrated astronomer and mathematician of Alexandria towards the close of the fourth century after Christ, at which period she was born. Her father taught her not only all the usual branches of learning, but also geometry, astronomy, and finally philosophy. She acquired a great reputation in the last-named study, and as a lecturer in the school of Plotinus gathered a numerous auditory of students from all parts of the East. She was as virtuous and beautiful as she was learned. But the jealousy and intolerance of Cyril, the Patriarch of Alexandria, were aroused at the influence exercised by Hypatia; the lower and more ignorant clergy in particular were stirred against her, and at length a number of them, having excited a popular tumult, seized her as she was returning from the schools, dragged her through the streets of Alexandria, stripped her naked, and finally murdered her with circumstances of the greatest barbarity (415). She is the heroine of Charles Kingsley's romance *Hypatia, or New Foes with an Old Face.*

Hyper′bola, one of the conic sections (q.v.). In the figure, S is the *focus*, Xx is the *directrix*,



SX is perpendicular to Xx, and PM is the perpendicular to the directrix from P on the curve, so that SP = e·PM. The constant e is called the *eccentricity.* The curve is symmetrical about SX, and also about a line B′CB perpendicular to SX. It has therefore another focus and directrix, S′ and X′x', so that S′P = e·PM′. SX meets the curve in the *vertices* A, A′. AA′ is called the *transverse axis*, B′B the *conjugate axis.* The curve has two branches extending to infinity. The tangents from the *centre* C, which touch the curve at infinity, are the *asymptotes* CT, CT′; the curve approaches these lines indefinitely as it recedes from C. If AT, the tangent at A, meets an asymptote in T, then CT = CS, so that, if CA = a, and AT = b, we have $CS^2 = a^2 + b^2$. Since CS = ae, e is given by $a^2e^2 = a^2 + b^2$. In an *equilateral*, or *rectangular, hyperbola* $a = b$, and the asymptotes are at right angles. See *Cone*; *Conic Sections*; *Geometry.*

Hyper′bole (-bo-lē), a rhetorical figure, in which an idea is expressed with a fanciful exaggeration of phrase which is not to be taken too literally, but only as representing a certain warmth of admiration or emphasis. ‘ His fame reaches to the stars ’ is an example of hyperbole.

Hyperbo′reans, the name given in early Greek legend to a people who lived ‘ beyond (*hyper*) Boreas ’ or the north wind, and were not exposed to its blasts, but enjoyed a delightful climate and perpetual health. Their natural life lasted 1000 years, and was spent in the worship of Apollo.

Hyperica′ceæ, or **Hyperici′næ**, a nat. ord. of plants, of which the genus Hypericum or St. John's wort is the type. They are herbs, shrubs, or (rarely) trees, with simple, opposite (rarely whorled) leaves. They have terminal or axillary, solitary, cymose or paniculate flowers, usually yellow or white. These plants abound in resinous juice, and many of them possess medicinal properties.

Hyperi′des, an Athenian orator, the pupil of Plato and Isocrates, born about 390 B.C. Along with Demosthenes and Lycurgus he was one of the leaders of the patriotic and anti-Macedonian party. As an orator he was specially distinguished for his grace and subtlety of expression, as well as for his tact in handling the question under consideration. He was murdered at Ægina by the emissaries of Antipater in 322 B.C. Of his orations one has reached us nearly entire; the others only in fragments.

Hyperion (hī-pėr-ī′on or hī-pē′ri-on), in the most ancient mythology of Greece, the god of the sun, afterwards identified with Apollo; also one of the Titans (q.v.).

Hy′persthene, a black pyroxene (see *Augite*) crystallizing in the ortho-rhombic system. Its colour is brownish-black; through the development of minute mineral plates within it, it sometimes has an almost metallic sheen. It was first found on the coast of Labrador, and was called Labrador hornblende. It is a constituent of many andesite lavas.

Hyper′trophy, literally over-nourishment, is an excessive development of any part of the body or any of its organs by actual increase of the particular parts composing it, as increase of muscular fibre in the heart. It arises from continued oversupply of blood to the part, due it may be to chronic irritation of the part, as, for example, thickening of the skin in the neighbourhood of a chronic ulcer; or it may be due to excessive use of the part. For example, one of the common forms of heart disease is the result of damage inflicted by disease on the valves, interfering with their efficiency. To compensate for their imperfect action the heart has to perform more work, and consequently its muscle becomes increased in bulk. Thus hypertrophy of the heart is a vital compensation for inefficient valves.

Hypha, the name applied to any one branch of the filamentous thallus or *mycelium* of a fungus.

Hyphomyce'tes, the largest section of the Fungi Imperfecti, distinguished by their conidium-bearing hyphæ (conidiophores) being produced singly or in small tufts (not in layers, nor enclosed in special receptacles). Examples: Botrytis, Fusarium, Helminthosporium.

Hypnot'ics, a term applied to drugs or other agents that induce sleep. Thus a hot bath or a heavy meal, by deflecting the blood stream to the skin or the organs of digestion respectively, may reduce the blood-supply of the brain and so exert a hypnotic influence. To a sedentary town-dweller exercise in the fresh air of the country often has a very pronounced soporific effect. But most hypnotics are narcotic drugs that lower the excitability of the nerve-cells in the brain, and so help to induce sleep. This result may be attained by numbing pain or discomfort that prevents the normal process of falling asleep, or it may be brought about by actual narcosis. For example, alcohol, if taken in sufficient quantity, may produce drowsiness or deep sleep; and many other poisons that have no specific pain-relieving properties can induce somnolence and unconsciousness.

The use of drugs to induce sleep is a pernicious practice that should be resorted to only under exceptional circumstances and on the advice of a medical man. After surgical operations or in patients suffering from incurable cancer it is often essential to relieve the pain by opium to permit sleep. But where insomnia is the result of worry, anxiety, or the memory of painful experiences it is inexcusable to resort to hypnotics to alleviate the distress, unless there are very special circumstances to justify such a course. In such cases the use of drugs often only aggravates the trouble, and suggests to the patient at a time when his self-control is weakened a dangerous way of forgetting his troubles. Most cases of the drug-habit and habitual inebriety are the result of the abuse of hypnotics as agents for dulling anxiety.

Hyp'notism in its fully developed form is a condition of sleep induced in the subject by another person who by means of verbal suggestion, ocular stimulation, or mechanical gestures conveys to the former the conviction that he will really fall asleep. The fundamental difference between hypnotic and ordinary sleep lies in the fact that in the former the subject is apt to receive and act upon suggestions made by the hypnotizer. Thus, for example, the subject readily accepts the assurance of the hypnotizer on matters that do not come into violent conflict with his feelings and emotions; he will believe that a piece of wood is an apple if he is confidently assured that such is the case, or he may lose neuralgic pains if he is persuaded that they are not real. Moreover, he will carry out complicated actions at the suggestion of the hypnotizer, not only when he is actually in the hypnotic state, but at some future time (post-hypnotic suggestion). For example, to a subject under deep hypnosis the hypnotizer may say that at four o'clock on the following day he will drink a glass of water. When the subject awakes he may be quite unconscious of the instructions given him; yet at the appointed time he will put the suggestion into effect, fully believing it to be a perfectly spontaneous and voluntary act.

One of the most startling aspects of hypnotism is the means it gives the hypnotizer of tapping the stream of unconscious experience. For example, the subject at some earlier period of his life may have had an experience that excited such intense feelings of aversion as to compel him to make terms with himself, in other words, to secure peace of mind by repressing all memory of the disturbing episode. Under hypnosis such painful memories hidden away in what modern psychologists call 'the unconscious' can be unveiled and brought to light. But hypnotism opens the way for the recall of every kind of unconscious memory, pleasant or unpleasant. For example, the writer once hypnotized a man (who believed that he was totally ignorant of foreign languages) and suggested to him that he was seven years of age. The subject at once lapsed into a childish way of speaking, and gave a detailed account of every incident on a voyage from England to a school in Germany, and then began talking a babyish variety of German. Hypnotism has been used therapeutically as a means of inducing sleep and anæsthesia, for creating in the minds of people over-addicted to drugs and alcohol an aversion from their particular poison, for recovering memory, and for overcoming pains such as neuralgias. But it is only in exceptional cases that its use is justifiable, and even then it must be employed with the utmost care and discretion, for the unveiling of forgotten experiences which are distressing and charged with emotional tone may upset a patient and do more harm than good; and hypnotism is a very potent instrument for exaggerating or even creating the types of emotional disturbance it is sometimes used to cure. Even in cases of dipsomania, where most dramatic results are sometimes obtained, the effects are usually transitory.

It is only a relatively small proportion of subjects that can be put into a state of deep hypnosis with complete loss of memory and subservience to the hypnotizer. The term hypnotism was introduced by Braid of Manchester (1796–1860), but the phenomena had long been known under a variety of names, such as mesmerism and animal magnetism. The development of the verbal method of suggestion and of hypnotism was mainly due to the Nancy school of physicians (see Bernheim's *Suggestive Therapeutics*, 1892). Perhaps the best popular account of the subject is Moll's *Hypnotism* (1890); for the more recent attitude see W. H. R. Rivers, *Instinct and the Unconscious* (Cambridge, 1920).

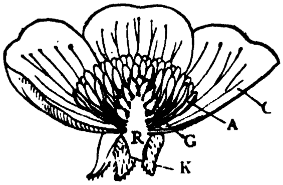
Hypnum, one of the largest genera of mosses, including above ninety species, natives of Britain. Many of the species are very large and ornamental.

Hypochlo'rites, unstable compounds, the salts of hypochlorous acid, HClO, chiefly important as powerful oxidizing and bleaching agents; not, however, when pure, but when containing chlorides. The chief hypochlorites, or at least the complex substances which contain hypochlorites, are bleaching-powder, and the bleaching liquors made with potash and soda.

Hypochond'ria, a disordered state of mind, the sufferer from which lives under the generally groundless apprehensions of different diseases. Uninterruptedly occupied with the state of his body, he takes notice of every feeling, and wishes to have every trifling pain explained, considering every one as a symptom of a serious disease. For everything he wants physic. Hypochondria is in itself not a dangerous state, although it makes the life of the sufferer a torment to himself and his friends. It is occasioned, as a rule, by worry and anxiety due to social or personal circumstances. The mental conflict created, for example, by financial embarrassment may affect the intellectual control of the emotions and render the victim an easy prey to those aches and discomforts which everyone experiences and the normal person disregards. The condition of hypochondria is favoured by too sedentary a life, by sexual indulgence or excess in alcoholic liquors; and also by want of exercise of the physical and mental powers producing ennui. It can be cured by facing the underlying worries and anxieties and learning to regard them rationally, and also by the avoidance of the habits likely to occasion it, by the adoption of a steady and regular life, with moderate exercise for the mind and body, and the help of cheerful society.

Hypoder'mic Injections are the injections of various substances, in liquid or semi-liquid form, beneath the skin by means of a syringe fitted with a hollow needle. The syringe and needle should be sterilized before the substance to be injected is drawn inside the syringe, and the skin around the part selected should be painted with some antiseptic. For this purpose iodine is most frequently used. After these preparations the needle should be rapidly introduced through the skin in a slanting manner so that it goes no deeper than through the skin itself, and the piston of the syringe then pushed slowly down to ensure that the liquid can pass through the narrow bore of the needle and enter the subcutaneous tissues. This method of administering drugs is now widely used when rapidity of action is required, to enable absorption of certain drugs to take place, for accuracy of dosage, and for any reason when it is not desirable to give drugs by the mouth.

Hypog'ynous Flowers, those with the stamens and other outer parts inserted below the gynœcium, as buttercup, wallflower, campion, primrose, and tulip.



Vertical Section of Hypogynous Flower

R, Receptacle. K, Calyx. C, Corolla. A, Andrœcium G, Gynœcium.

Hypophos'phites, the salts of hypophosphorous acid. The hypophosphites are all soluble in water, and readily change to phosphites and phosphates in presence of air. The sodium salt NaH_2PO_2 and the calcium salt $Ca(H_2PO_2)_2$ are used medicinally. These must be completely soluble in water and free from phosphites, which are poisonous.

Hypophos'phorous Acid, H_3PO_2, an acid obtained by decomposing barium hypophosphite with sulphuric acid; by careful evaporation the acid may be obtained as a white crystalline mass. The salts of this acid were discovered by Dulong in 1816, and are formed when phosphides of the alkali metals or the alkaline earth metals are decomposed by water, or when phosphorus is boiled with alkali. The barium salt $Ba(H_2PO_2)_2$ is the starting-point for the preparation of the acid or for the other salts. It is formed by boiling phosphorus with water and barium hydroxide. Sodium hypophosphite, NaH_2PO_2, and calcium hypophosphite, $Ca(H_2PO_2)_2$, are used medicinally. The acid is a strong reducing agent, and precipitates gold and silver from solutions of their salts, being itself transformed into phosphoric acid.

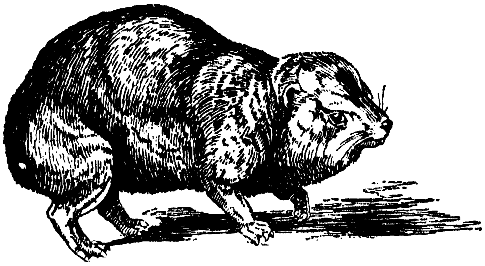
Hyposul'phites, or **Hydrosulphites**, the salts of hyposulphurous acid, sometimes termed hydrosulphurous acid, $H_2S_2O_4$. Sodium hyposulphite, $Na_2S_2O_4$, and calcium hyposulphite are the commonest of these hyposulphites. The sodium salt is usually prepared by reducing sodium bisulphite solution by metallic zinc, and removing the zinc by means of soda solution. Numerous patents have been taken out for the manufacture of the hyposulphites, and for a considerable time attempts have been made to prepare hyposulphite in a solid stable form. These attempts have not been successful, but stable compounds can now be obtained by uniting the salt with formaldehyde. Formaldehyde is united with sodium hyposulphite, potassium hyposulphite, calcium hyposulphite, &c., giving the corresponding double compound, and this is allowed to crystallize. According to the nature of the double compound, these have been given special trade names by the makers, e.g. 'Hydraldite', 'Eradite', 'Rongalite', 'Hydrosulphite NF', &c. These stable compounds are used by dyers, and in most cases they act as well as the salts themselves. The hyposulphites are strong reducing and bleaching agents, and are easily oxidized by the air. They are used for bleaching textiles such as feathers, horsehair, leather; as reducing agents in indigo vats, as they reduce indigo blue to indigo white; in printing fabrics as a discharge for colours; and for bleaching oils and soaps.

Hypoth'ec, in Scots law, a claim or right which a creditor has over the effects of a debtor while they still remain in the possession of the debtor. Thus a landlord has an hypothec over the furniture of his tenant in respect of the current rent, with certain limitations in the case of small houses and agricultural subjects. (See *Land Laws*.) In England those rights are called *liens*.

Hypoth'esis (Gr. *hypo*, under, and *thesis*, putting; groundwork, foundation), etymologically a supposition, is popularly used to denote something not proved, but assumed for the sake of argument. In scientific and philosophical usage it denotes either a probable theory of phenomena not yet fully explained, or a strictly scientific theory which accounts for all the known facts of the case, and which only needs the verification of subsequent observations and deductions to become a certainty. Thus the conjecture of Newton that the force of gravity, as exemplified on the earth, might extend to the moon, was in its first stage a probable hypothesis; but when it was found to account for all the facts, it became a scientific hypothesis or theory.

Hyracothe'rium, a genus of fossil ungulates, belonging to the odd-toed division, and of very primitive type. It is regarded as one of the earliest predecessors of the horse, and occurs in Lower Eocene strata in Europe, including England, and America. The species are of the size of a hare.

Hy'rax, or **Procavia**, a genus of hoofed mammals, and the most primitive recent type of that order. It is the only genus of the sub-ord. Hyracoidea, characterized by having no permanent canine teeth but long curved incisors, used for gnawing, and growing continuously throughout life. The front feet have four toes, and the hind feet three. They are small animals, often known as conies (coneys), native to Africa, Syria, and Arabia. The Cape hyrax is by the colonists of South Africa called *Rock-badger* and *Rock-rabbit*.

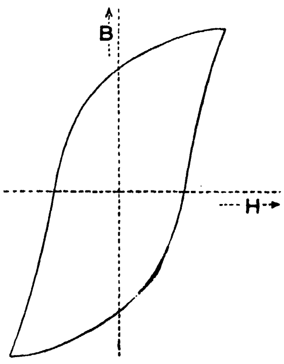

Abyssinian Hyrax (*Hyrax abyssinicus*)

Hyrca'nia, a province of ancient Asia, corresponding to what are now the northern parts of Khorasan and Mazanderan, along the Caspian Sea.

Hyrca'nus, the name of two Jewish high-priests and rulers of the Asmonean family.—John Hyrcanus, the son and successor of Simon Maccabæus, assumed the title of prince and high-priest in 137 B.C., freed Judæa from the yoke of the Syrians, and founded a dynasty of rulers which lasted till the accession of Herod. He also subjugated the Samaritans and Idumæans. He died 105 B.C., leaving five sons, two of whom, Aristobulus and Alexander, afterwards governed with the title of kings.—John Hyrcanus II, grandson of the former, was appointed king in Jerusalem, but was forced by his brother Aristobulus to retire into private life. Pompey, however, appointed him high-priest in 63 B.C. About 40 B.C. he was taken prisoner by the Parthians and carried with them to Seleucia. Here he remained till he was invited to Jerusalem by Herod, son of Antipater. Being suspected of plotting against Herod, he was put to death 30 B.C.

Hyssop (Hyssŏpus), a genus of plants of the nat. ord. Labiatæ. The common hyssop (*Hyssŏpus officinălis*) is a perennial shrubby plant rising to the height of 2 feet, a native of Siberia and the mountainous parts of Austria, but common in English gardens. It flowers from June to September. The leaves have an agreeable aromatic odour, and a slightly bitter and somewhat warm taste. It was once employed as a medicine, but has now fallen into disuse. The hyssop of Scripture (the symbol of spiritual purification from sin) is generally identified with the caper (*Cappăris spinōsa*).

Hysteresis (from a Greek word *hysterein*, meaning ‘ to lag ’) is the name given to a certain magnetic phenomenon. The state of magnetization of a piece of iron can be recorded by drawing a graph of its ‘ magnetic induction ’ (B) corresponding to the applied ‘ magnetic force ’ (H). (See *Magnetism.*) If the magnetic field (or force) is an *alternating* one, the magnetic induction does not have precisely the same value, for any given value of the applied magnetic field, as it would have if the field were a steady one. When the applied magnetic field is getting weaker, the magnetic induction is greater than it would be with a steady field of the same value, and when the magnetic field is getting stronger, the magnetic induction is lower, so that changes in the magnetic induction ‘ lag behind ’ those in the applied field. The result is that the iron goes through a cycle of magnetization which can be represented by a curve (see fig.). The area of this curve is proportional to the amount of energy which is given to the iron, per cycle, and dissipated in it as heat energy. A vast amount of experimental work has been done to determine the law of ‘ hysteretic loss ’. The best experiments agree with the following law, which is known as Steinmetz's Law.



If w is the loss in ergs per cubic centimetre per cycle, η *a constant,* B *the maximum magnetic induction in lines per square centimetre, then* $w = \eta B^{1\cdot 6}$. The value of the constant η varies a great deal with different materials, and it is obviously a highly important point in electrical engineering to discover irons possessing low hysteretic losses. One of the best of such armature irons is known as ‘ stalloy ’ iron, which is an iron containing 3½ per cent of silicon. It has a hysteretic constant of about 0·0007.

Example: The armature core iron (stalloy) of a D.C. generator weighs 1000 lb. It is a 6-pole machine, running at 500 r.p.m. The maximum magnetic induction in the iron is 100,000 lines per square inch; find the hysteretic loss.

$$B = \frac{100{,}000}{2\cdot 54^2} = 15{,}400 \text{ lines per sq. cm.}$$

Since 1 Joule = 10^7 ergs and 1 watt = 1 Joule per second.

$$\text{Loss in Watts} = 0\cdot 0007 \times 15{,}400^{1\cdot 6} \times \text{vol. of iron in c. c.} \times \text{cycles per sec.} \div 10^7.$$

$$\therefore \text{Loss in Watts} = \frac{0\cdot 0007 \times 15{,}400^{1\cdot 6} \times 150}{2\cdot 205 \times 7\cdot 86 \times 60}$$
$$= 506\cdot 2.$$

—Cf. C. P. Steinmetz, *Alternating Currents.*

Hyste′ria (Gr. *hystera*, womb), a term applied to a peculiar functional nervous disorder in members of either sex that sometimes follows some intense emotional disturbance, such as a blighted affection in an adolescent girl, or the exposure to the risk of death in a railway accident, or the anxieties of modern warfare. At one time the affection was supposed to be peculiar to women and to be due to some disorder of the womb, which in ancient times was supposed to be able to wander about the body and produce the remarkable local manifestations of the ailment. But the term hysteria was probably first applied to the emotional state into which devotees of the goddess Aphrodite got worked up in the orgies that took place on New Year's Day when the annual festivals of the goddess were celebrated.

The condition to which the term is applied in modern medicine is peculiarly liable to develop in girls during the period of adolescence, and especially as the result of some intense emotion of a sexual nature. The patient is peculiarly prone to sudden emotional storms, ending in tears or laughter, or in severer cases in a fit that may simulate an epileptic attack. But localized or widespread paralysis or weakness of muscles may occur, and especially modifications of the sensitivity of the skin, either localized or general anæsthesia or hyperæsthesia. Loss of voice, deafness, or temporary loss of any of the special senses may also occur. A well-known form of hysteria that may occur in either sex is the disorder known as *railway-spine*. A passenger in a train which has been in a collision may at some time after the accident develop paralysis or sensory disturbances without any physical injury to account for them. In the European War many thousands of soldiers, as the result of the stress and strain of the terrible conditions of modern warfare, fell victims to hysteria and developed mutism, functional deafness or blindness, paralysis of localized groups of muscles, and all sorts of disturbances of sensation. Such conditions are the result of the prolonged strain which is involved when men are constantly in danger of sudden death. It occurs especially among men in the ranks, who are used to obey orders or suggestions and are not subject to the mental strain of their commanding officers, who have to make decisions and give orders. The latter are liable to become the victims of anxiety-neurosis, whereas the former find relief from the strain in the paralyses and anæsthesias of hysteria.

The only rational treatment of hysteria is that based upon the analysis of the symptoms and the revelation of the true cause of the trouble. But good food and rest are important adjuvants in the treatment; and the patient should be placed under such conditions as will shield him or her from all emotional excitement or from any circumstances likely to reawaken the original cause of the disturbance. Drugs and isolation are dangerous palliatives that are likely to do more harm than good in most cases.—Cf. W. H. R. Rivers, *Instinct and the Unconscious.*

Hythe (hīth), a parliamentary and municipal borough of England, one of the Cinque Ports, in the county of Kent, 11 miles w.s.w. of Dover, to the west of Folkestone, at the foot of a steep hill or cliff. It was anciently a place of great importance; but its harbour has been entirely silted up. Hythe is the seat of the principal Government school of musketry. A promenade over 5 miles along the coast was opened in 1881. Hythe unites with Folkestone in sending one member to Parliament. Pop. 7764.

I

I, the ninth letter and the third vowel of the English alphabet, in which it represents not only several vowel sounds but also the consonantal sound of *y*. The two principal sounds represented by it in English are the short sound as in *pit*, *pin*, *fin*, and the long as in *pine*, *fine*, *wine*, the latter being really a diphthongal sound. It has also three other sounds, viz. that heard in *first*, *dirk* (ė, the neutral vowel); that heard in *machine*, *intrigue* (which, however, can scarcely be considered a modern English sound); and the consonant sound heard in many words when it precedes a vowel, as in *million*, *opinion*, *trunnion*. I and J were formerly regarded as one letter.

Iamblichus (I-am′bli-kus), a Greek Neo-Platonic philosopher, a native of Chalcis in Cœle-Syria, who flourished in the beginning of the fourth century after Christ. He was the pupil of Porphyry, and having become perfect in the doctrines of the Plotinian school, he taught with vast reputation. His school produced many eclectic philosophers, who were dispersed throughout the Roman Empire. His philosophical works now extant are: a *Life of Pythagoras*; an *Exhortation to the Study of Philosophy*; *Three Books on Mathematical Learning*; a *Commentary upon Nicomachus' Institutes of Arithmetic*; and a *Treatise on the Mysteries of the Egyptians, Chaldeans, and Assyrians.* He died at Alexandria about 333.

Iam′bus, in prosody, a foot of two syllables, a short and a long one (⏑ —), or an unaccented syllable followed by an accented one. The iambic metre is the fundamental rhythm of many English verses. The verse of five iambic feet is a favourite metre, being the heroic verse of English, German, and Italian poetry.

Ian′thina (Gr. *ianthinos*, violet-coloured), a genus of oceanic gasteropodous mollusca, with a thin violet-coloured snail-like shell. When irritated, they pour out a violet secretion, which serves for concealment, in the manner of the ink of the cuttle-fish.

Ib′adan, a town of Western Africa, in the colony of Lagos, 122 miles from Lagos by railway. Pop. 175,000.

Ibagué (ē-bȧ-gā′), a town of South America, Republic of Colombia, department of Tolima. There are sulphur- and silver-mines in the vicinity. Pop. 15,000.

Ibañez, Vicente Blasco, Spanish politician and novelist, born 1867. A prolific writer, his works are vivid in their portrayal of the customs, habits, and daily life of Southern Spain; and English translated editions have found much favour. Politically he is of revolutionary principles, and a powerful advocate of social reforms in Spain. Among his best works (in English) are: *The Matador*, an excellent sketch of bull-fighting and bull-fighters, and *The Four Horsemen of the Apocalypse*, an extraordinary war novel, first translated in 1918.

Ibar′ra, a town of Ecuador, in South America, capital of the province of Imbabura, at the foot of the volcano of the same name, 30 miles north of Quito. It was almost entirely destroyed by an earthquake in 1868. Pop. estimated at 10,000.

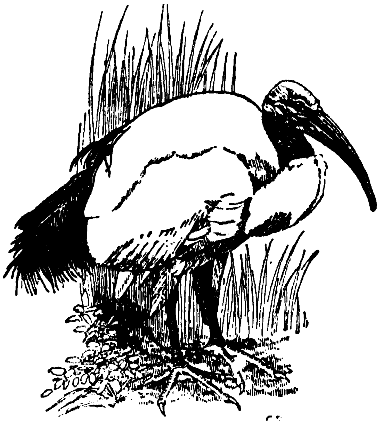
Ibe′ria, in ancient geography: (1) A fertile district in Asia, between the Euxine and Caspian Seas, which consisted of a plain surrounded by mountains, a part of modern Georgia. (2) An ancient name of Spain, from its river, the *Ibērus* (Ebro). The Iberi or Iberians, probably the most ancient European nation, formed the basis of the population of Italy, Gaul, Spain, and Lusitania (Portugal). Their language still lives in the Basque. The Celts, who entered the country later, were intermingled with them, the conjoined people being called Celtiberians.

I′bex, a name of two or three species of goats. The horns of the male are flattened, have two longitudinal ridges at the sides, and are crossed by numerous transverse knots. The horns of the female are short, more erect, with three or four knots in front. The best-known varieties are the *Capra ibex* of the Alps and Apennines, the steinbock of the Alps, and the *C. pyrenaica*, the Pyrenean steinbock. Another species, *C. ægagrus*, the Persian wild goat, inhabits the lofty rocky peaks of the Caucasus Mountains, and ranges from there to Sind. Concretions found in its stomach were formerly of repute as antidotes against poison, under the name of 'bezoar stones'.

Persian Wild Goat (*Capra ægagrus*)

Ibicui (ib′i-kų-ē), a river of Brazil, which rises in the Serra de Santa Anna, state of Rio Grande do Sul, and joins the Uruguay after a course of 400 miles.

I′bis, a genus of birds allied to the storks, and the type of a special family (Ibididæ), the most remarkable species being the *Ibis æthiopica*, or sacred ibis. This is found throughout Africa. It is about the size of a common fowl, with head and neck bare, and white plumage, the primaries of the wings being tipped with black and the secondaries being bright black, glossed with green and violet. It was one of the sacred birds of the ancient Egyptians, and was usually mummified. The cause of its being deemed sacred was no doubt because it appeared in Egypt with the rise of the Nile; but it is now rare in that country, living farther south. Related species are found in Madagascar, South Asia, and the Australian regions. Of allied forms may be mentioned: scarlet and white ibises of tropical America (*Eudocimus ruber* and *E. albus*), the glossy ibis (*Plegadis falcinellus*) ranging through most of the Old World, and the straw-necked Australian ibis (*Carphibis spinicollis*). Spoonbills (Platalea, &c.) belong to the same family.



Sacred Ibis (*Ibis æthiopica*)

Ibn-Batu′ta, an Arabic traveller, born at Tangiers 1304, died at Fez 1377. He visited Egypt, Syria, Arabia, Persia, Central Asia, India, China, the Eastern Archipelago, East Africa, Central Africa, &c., and wrote an account of his travels.

Ibrahim Pasha, an adopted son of Mehemet Ali, Viceroy of Egypt, born in 1789, died in 1848. He first gave signal proofs of his courage and military talents in the war with the Wahabis of Arabia, whom he completely defeated, and in the subjugation of Sennaar and Darfur. In 1825 he invaded the Morea at the head of an Egyptian army, with the view of conquering Greece for his father; but in 1828, in consequence of the interference of the Great Powers, was obliged to abandon the attempt. To effect his father's purpose of making Syria a bulwark to his new Egypto-Cretan kingdom he, in 1831, crossed the Egyptian frontiers with an army, overran Palestine, took St. Jean d'Acre by storm, and made himself master of all Syria. The campaign terminated by an arrangement in which the Porte ceded Syria, and conferred the pashalic of Adana, by a kind of lease, personally on Ibrahim. In no long time war with the Sultan again broke out, and resulted in a great defeat of the Turkish forces at Nizib in 1839. By the interference of the Great Powers Ibrahim was eventually obliged, after retiring from all his Syrian conquests, to return to Egypt, marching across the desert from Damascus with great loss and suffering. From this time he seldom appeared in public life, and employed himself chiefly in the improvement of his own estates. In 1846 he visited England and France. In 1848 Ibrahim, after his father had become imbecile, proceeded to Constantinople, and was nominated Viceroy of Egypt, but he died in the same year at Cairo, while Mehemet Ali was still alive. He was succeeded by Abbas Pasha, the favourite grandson of Mehemet Ali.

Ib′sen, Henrik, Norwegian dramatist and poet, was born on the 20th March, 1828, and died on the 23rd May, 1906. His father was a business man who went bankrupt when Ibsen was eight years of age. Ibsen's great-grandmother was Scottish, and his grandmother and mother were German. On account of his father's insolvency Ibsen had an unhappy boyhood and youth, which helped to make him somewhat soured and bitter. He had only a very brief education at a scientific school at Skien, and from his sixteenth to his twenty-third year he drudged in an apothecary's shop. In 1850 he entered the University of Christiania, but did not remain there long, afterwards earning a livelihood as best he could by means of journalism.

His blank-verse tragedy *Catilina* was published in 1850. In 1851 he was appointed director of Ole Bull's Theatre at Bergen. This was an unimportant post, but it ensured a regular salary and a security from financial worries. He wrote several romantic plays for this theatre, the most important of them being *Mistress Inger at Östraat*, which appeared in 1855. *The Feast at Solhaug*, a tragedy, appeared in 1856. In the next year Ibsen returned to manage the National Theatre at Christiania, and soon produced a fine saga-drama, *The Warriors in Helgeland*, which is based upon Icelandic legends. A very clever drama in rhyme, *Love's Comedy*, was published in 1862, and two years later appeared *The Pretenders*, another fine saga-drama in prose. In 1862 Ibsen's theatre became bankrupt, and he vainly attempted to obtain a pension from the Government. He left Norway in 1864, and did not return permanently until 1892, living in the meantime at Rome, Dresden, and Munich. In 1866 his pension was granted by the Government, and he was able to live in comparative comfort. In the same year he published his magnificent poem *Brand*, in which he depicts an austere clergyman who will not compromise with anything which he considers to be evil. *Peer Gynt*, which is in a sense complementary to *Brand*, appeared in 1867. If Brand was strong-willed to a fault, Peer Gynt is just the opposite, weak-willed, devoid of enthusiasm, nurtured on fairy-tales, and egotistic. He represents Ibsen's idea of a typical Norwegian of the day. *Peer Gynt* is the most polished of all Ibsen's poetical works; it is full of variety, and of a wealth of imagination and poetry. It was the first of Ibsen's works to carry his reputation beyond the boundaries of Norway. In 1869 Ibsen produced his first realistic prose play, *The League of Youth.* This is a political comedy, immature in some respects, but in others foreshadowing some of his later masterpieces. In 1873 he published the last of his historical plays, the immensely long *Emperor and Galilean*, which deals with Julian the Apostate and his struggle with Christianity. After this Ibsen began his series of social plays, which were at the beginning more or less completely matter of fact and realistic, but which became more and more mystical in tone as the poet grew older. *Pillars of Society* (1877) deals with the hypocrisy of a prosperous middle-class family. It is somewhat immature; Ibsen did not shake himself free from the influence of Scribe and his school for some time. *A Doll's House* (1879) was written to shock the conventionally-minded by means of new ideas about women's rights and privileges. It succeeded in its object, and still remains the most discussed of Ibsen's plays. Nora, the heroine, was the first to air the theory that a woman has a duty to herself as well as to her parents and her husband. *Ghosts* (1881) is a still more unpleasant play, which deals mainly with the question of heredity and which introduces disease as a factor in the plot. It was ferociously attacked on its appearance in Norway. *An Enemy of the People* (1882) is a companion-piece to *Ghosts*, as it was written as a protest against the reception of that play. Though it is a polemical piece of writing, it is perhaps the most agreeable, or at any rate the least disagreeable of Ibsen's society plays. Doctor Stockmann, the hero, is the most sympathetic character in all the plays. There is an allegory running through this play and foreshadowing the mysticism of the later plays. *The Wild Duck* (1884), which is a masterpiece of construction, is in other respects an unsatisfactory and unprofitable play. It is full of sordid details, and its characters are nearly all fools or scoundrels or both. *Rosmersholm* (1886) is another masterpiece of construction; the retrospective method is used in it more skilfully than anyone had used it since Sophocles wrote the *Œdipus Tyrannus*. *Rosmersholm* is a tragic play, but it is not petty or bitter as some of the other plays are. It has claims to be considered Ibsen's masterpiece. The subsequent plays become more allegorical and less realistic. *The Lady from the Sea* (1888), unlike most of the plays, has not been overrated by the critics; it is, however, in many respects a better play than its successors. It hinges upon the idea that anyone who has perfect freedom to choose their course of action will choose to do what is right. *Hedda Gabler* (1890) is another sordid and unpleasant play, depicting a type of modern woman who is afraid of motherhood, and who commits suicide because she cannot satisfy her petty social ambitions. *The Master Builder* (1892) is acclaimed by some critics as Ibsen's masterpiece, while others find it quite devoid of meaning. It is an unsatisfying compromise between allegory and realism. It has been responsible for producing much ill-considered criticism. *Little Eyolf* (1894), like *A Doll's House*, deals with the problems of married life, but it is written in a more mature style. *John Gabriel Borkman* (1896), a strong but decidedly unpleasant play, is the last of the great plays. In *When We Dead Awaken* (1900) there are clear traces of Ibsen's mental collapse. In 1901 he broke down completely, and grew steadily worse until he died in 1906.

Ibsen's work, which is repellent in some respects, has in other ways been most beneficial to European drama. It has had an immense influence on the modern theatre, an influence far greater than that of any other dramatist of the nineteenth century. Ibsen's mature plays are masterpieces of technique; his dialogue is natural and life-like, and his plots have the inevitability of Greek drama. Ibsen did much to rid the stage of some of its absurd conventions, such as the soliloquy and the aside. In all these respects his influence has been entirely for good. As a moral teacher he has been much less successful. He is too apt to vex and irritate, to destroy without reconstructing, and to raise questions to which he can supply no answer. His characters are nearly all mean and contemptible, and many of his plots morbid and removed from the high road of life. Men and women are not so black as Ibsen paints them; there are many who live normal, sane, decent, and unselfish lives. After a course of Ibsen we turn with relief to Homer and Shakespeare, where life is lived in a noble and spacious fashion. The difference between Ibsen and Shakespeare is the difference between the stuffy smoke-room of a provincial Norwegian hotel and the Forest of Arden or the sea-coast of Bohemia.—BIBLIOGRAPHY: E. Gosse, *Life of Henrik Ibsen*; G. B. Shaw, *The Quintessence of Ibsenism*; H. H. Boyesen, *A Commentary on Ibsen*; G. Brandes, *Björnson och Ibsen*; H. Rose, *Ibsen: Poet, Mystic, and Dramatist*; A. S. Rappoport, *Ibsen, Nietzsche, and Kierkegaard* (in *New Age*, 1906).

Ib'ycus, a Greek lyric poet, born at Rhegium, Italy, in the sixth century B.C.; lived mostly at Samos in the court of Polycrates. When about to be murdered by robbers, he declared that cranes flying overhead would avenge him; and an involuntary utterance by one of the ruffians on seeing a flock of cranes led to their seizure, confession, and execution. His poetry was chiefly erotic, but is known only by fragments.

I'ca, a coast department of Peru; area, 8718 sq. miles; pop. 90,960.—Its capital, Ica, lies in the fruitful valley of the River Ica; pop. 9000.

Ice, water frozen into a solid mass. Ice crystallizes in hexagonal plates or short columnar prisms, and in six-rayed star shapes in snow. It has a specific gravity of ·918, possesses the property of double refraction, and has a mean refractive index of 1·309 for yellow light. Water freezes when its temperature is reduced below a certain point, which is by universal consent made a fixed point on thermometers. That point is called zero on the Centigrade and Réaumur scales, and 32° on the Fahrenheit scale. Water near the freezing-point presents the curious anomaly of expanding instead of contracting as the cooling process goes on. At 4° C. (39·2° F.) water has its maximum density-point. At temperatures below 4° the volume of the water increases as the temperature falls, and decreases as the temperature rises; and at the moment of solidifying the volume of the mass suddenly increases by about 9 per cent, so that ice at the temperature of freezing is one-eleventh greater in bulk than the water from which it is formed is at 4°. It is on this account that water freezes at the top first, and that ice when frozen floats at the top of the water. The temperature at which pure water becomes ice is very nearly constant under ordinary circumstances; and it is this fact, along with the ease of procuring water at the freezing temperature, or rather ice at the point of liquefaction, that has caused this temperature to be adopted as one of the fixed points in thermometers. The freezing-point is, however, slightly influenced by pressure. Increase of pressure lowers it, and the removal of pressure raises it. Salt water requires a lower temperature to freeze it than fresh water, and in the process a large part of the salt is rejected. Hence water obtained from the melting of sea-ice is nearly fresh. If water is kept perfectly at rest, it may be reduced in temperature far below the freezing-point without turning into ice; but particles of solid matter such as dust must also be kept from falling into it. The expansion of water on its conversion into ice often gives rise to the exhibition of very great force, and produces very remarkable effects in nature. Much of the disintegration observed in rocks and stones during or immediately after frost is due to it, water having entered into their pores and cavities and burst off particles by its expansion. Ice, though it is very hard and brittle, possesses the property of plasticity to a very remarkable degree, and can be moulded into any form by the application of pressure. The plasticity of ice is a property of very great importance. It was discovered by Forbes, who explained the motion of glaciers by it. (See

Glaciers.) In nature ice appears in the greatest masses in the form of glaciers and icebergs, the latter being portions which have become detached from glaciers that extend down into the sea. Ice is now an article of considerable importance from a commercial point of view, large quantities of it being shipped to warm climates from countries where it is naturally produced in abundance in winter, as the United States or Norway. Ice can now be made cheaply by certain processes and apparatus (see *Ice-making and Refrigeration*), and a very pure and excellent article is thus produced.

Ice Age, in geology, an epoch during which a lowering of temperature has occurred over large regions, and perhaps over the whole of the earth, so that the precipitation of atmospheric moisture in the solid form has caused a marked extension of snow-fields and glaciers over the surface. See *Glacial Epoch.*

Icebergs, large masses of ice floating in seas or lakes, and originating in the breaking up of land-ice on a shore-line, particularly where glaciers are pushed out towards the sea. The glacier, undermined by the warmer water, and floated upwards as its front protrudes, is said by whalers to 'calve', as huge masses break off along the vertical cracks, accompanied by showers of fragmental ice. The Arctic icebergs are well known off the mouth of the St. Lawrence, where, in foggy weather, they form a great menace to shipping. They tower up out of the sea in fantastic forms, with about seven-eighths of their bulk below water. The numerous air-bubbles in glacier ice, and the density of sea-water, cause them to rise higher above the surface than would be the case with lake-ice in fresh water. The Antarctic glaciers, which may be several miles in length, are typically huge tabular masses, increased by sea-water freezing on their bases, and in part formed on an ice-front that has been pushed out far seaward from the land. *Floe-ice* arises from the freezing of the sea, and a large part of the *pack-ice* of polar seas consists of floes broken by wave-action, masses becoming heaped on one another. Icebergs distribute a considerable quantity of material on the sea-floor, particularly blocks of rock gathered into the lower portions of the glaciers from which they have been formed.

Iceberg breaking off from End of Glacier

Iceland, an island under the same sovereignty as Denmark, situated between the North Atlantic and the Arctic Oceans, 250 miles from Greenland and about 600 miles west of Norway; greatest length, east to west, 300 miles; central breadth, about 200 miles; area with adjacent isles, 39,709 sq. miles; pop. 92,000. In shape it somewhat resembles a heart with its narrowest point turned south. The coast-line for a considerable extent on the south-east is almost unbroken, but in all other directions presents a continued succession of deep bays or fiords and jutting promontories, thus affording a number of natural harbours. The interior has generally a very wild and desolate appearance, being covered by lofty mountain masses of volcanic origin, many of them crowned with perpetual snow and ice, which, stretching down their sides into the intervening valleys, form immense glaciers. These icy mountains, which take the common name of Jökul, have their culminating point in Öräfajökul, which is situated near the south-east coast, and has a height of 6409 feet. Among the volcanoes the most celebrated is Mount Hecla, in the south, about 5000 feet high. Numerous hot springs or *geysers* are scattered throughout the island, but are found more especially in the south-west, to the north-east of Reikjavik. (See *Geysers.*) There are numerous lakes and rivers. The most valuable mineral product is sulphur, of which the supply appears to be inexhaustible; the other minerals deserving of notice are chalcedonies, rock-crystals, and the well-known double-refracting spar, for which the island has long been famous. There is a kind of brown coal which to some extent serves as fuel. The climate is mild for the latitude, but the summer is too cool and damp for agriculture to be carried on with much success. In the southern parts the longest day is twenty hours, and the shortest four, but in the most northern extremity the sun at midsummer continues above the horizon a whole week, and of course during a corresponding period in winter never rises. Vegetation is confined within narrow limits. Almost the only tree is the birch, which has a very stunted growth, the loftiest hardly exceeding 10 feet. There are various flowering plants, among which saxifrages, sedums, and thrift or sea-pink are common. Heath and bilberry cover large stretches. Among mosses or lichens are the edible Iceland-moss (q.v.). Cole, potatoes, turnips, radishes, and similar roots thrive tolerably well. But by far the most valuable crop is grass, on which considerable numbers of live stock (sheep, cattle, ponies) are fed. The reindeer, though not introduced before 1770, has multiplied greatly and forms large herds in the interior; but they are of little importance economically. Wild-fowl, including the eider-duck whose down forms an important article of commerce, are abundant; the streams are well supplied with salmon, and on the coasts valuable fisheries of cod and herrings are carried on. Manufactures are entirely domestic, and consist chiefly of coarse woollen goods, mittens, and stockings. The exports are wool, oil, fish, horses, feathers, worsted stockings and mittens, sulphur, and Iceland-moss.

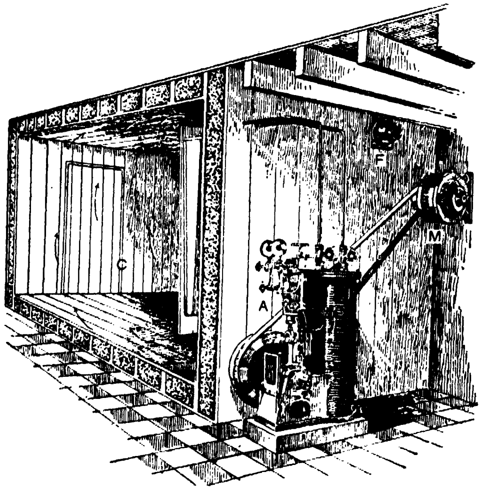
The inhabitants are of Scandinavian origin, descendants of the ancient Vikings, and speak a Scandinavian dialect, which still represents the old Norse or Norwegian in great purity. They are of the Protestant religion. The Constitution of Iceland is embodied in the Charter of 5th Jan., 1874, modified by the laws of 3rd Oct., 1903, and 19th June, 1915. Till 1918 Denmark exercised the whole power in common affairs, but by the Act of Union of 1st Dec., 1918, Iceland became a sovereign state, united with Denmark only through the identity of the sovereign. There is an *Althing*, or Parliament, which meets at Reikjavik, the capital, and consists of forty members, of whom thirty-four are chosen by popular suffrage, and six nominated by the king. The Althing is divided into two Houses, the Upper House and the Lower House. The executive power is exercised by a Ministry divided into three departments. Reikjavik has 16,154 inhabitants.

History.—Some settlements of Irish monks had been made in Iceland about the end of the eighth century, but the island received the greatest proportion of its population from Norway. In 870 Harald Haarfager had made himself supreme in Norway, and as he treated the landed proprietors oppressively, numbers left the country and went to Iceland. In the course of sixty years all the habitable parts of the coast were settled. A settled government was established, a sort of aristocratic republic, which lasted for several centuries. Christianity was introduced in 981, and adopted by law in 1000; and schools and two bishoprics, those of Holar and Skalholt, were established. The Latin language and the literature and learning of the West, introduced by Christianity, were all the more warmly received because poetry and history had already been cultivated here more than elsewhere in the Germanic north. Previously to this time the Icelanders had discovered Greenland (983) and part of America (about 1000), and they were now led to make voyages and travels to Europe and the East. Politically and ecclesiastically the most flourishing period of Iceland—the period, too, when its intercourse with the world abroad was most active—was from the middle of the twelfth to the beginning of the thirteenth century. In 1264 Magnus VI of Norway united Iceland with his own kingdom, with which it passed to Denmark in 1380, remaining with the latter in 1814, when Norway was joined to Sweden.

Language and Literature.—The Icelandic language is the oldest of the Scandinavian group of tongues, and as it is believed to exhibit the Norse language nearly as it was spoken at the date of the colonization of Iceland, it is sometimes called *Old Norse*. It is rich in roots and grammatical forms, and soft and sonorous to the ear. Icelandic literature may be divided into an ancient period, extending to the fall of the republic, and a modern, extending from that date to the present time, the former being far the richer and more original. Poetry was early cultivated, and among the most important works in Icelandic literature is the collection of ancient heathen songs called the *Elder* or *Poetic Edda* (q.v.). Histories and romantic works, known by the name of *Sagas*, are numerous. Many of these are masterpieces of prose style, and are still read with delight by the people of Iceland. The early portion of the second period was barren of anything worth mention in the way of literature, nor can the modern period boast at all of works possessing the interest of those belonging to the ancient, though since the middle of the eighteenth century there is scarcely a department of literature in which Icelandic writers have not done something. Among modern Icelandic authors, poets, and dramatists we may mention: Bjarni Thorarensen, Jonas Hallgrimson, Gestur Palsson, Thorstein Erlingsson, Hannes Hafstein, Matthias Jochumsson, and others.—Bibliography: S. Baring-Gould, *Iceland: its Scenes and Sagas*; D. Leith, *Iceland*; J. Stefansson, *Denmark and Sweden, with Iceland and Finland* (in Story of the Nations Series); Th. Thoroddsen, *Physical Geography of Iceland*; W. A. Craigie, *The Icelandic Sagas*; French, *Heroes of Iceland.*

Iceland-moss (*Cetrāria islandĭca*), a species of lichen found in the Arctic regions, and on the upper parts of lofty mountains, as, for instance, in Scotland. It is used in medicine as a mucilaginous bitter, and in Iceland is collected as a nutritious article of diet. When boiled with milk or water, it forms a jelly. Its bitterness may be removed by steeping.

Ice-making and Refrigeration. It is now no longer necessary for the safe conduct of a business dealing with perishable commodities to be dependent on the uncertainty of the climate, as, with artificial refrigeration, pure, dry, and cold atmosphere can be regulated to any desired temperature. The means of preserving these perishable commodities vary in size from the well-known small ice-chest to large cold storages capable of holding thousands of tons. These cold storages are divided into chambers or rooms, the walls, ceiling, and floors having to be carefully insulated to keep the heat of the atmosphere from reaching the cold interior of the chamber. The insulation varies from 3 inches to 7 inches thick, and is comprised of either charcoal, loose cork, slag-wool, or compressed cork, the last being the most up-to-date.



Small Self-contained Refrigerating Plant

A, Ammonia or Carbonic-acid compressor and condenser driven by motor M. F, Fan. C, Insulated cold-storage room.

The working substance generally employed on land installations of refrigerating plant is anhydrous ammonia (NH_3), i.e. ammonia free from water. Ammonia is a gas under ordinary conditions, but is easily condensed to a liquid by pressure and cooling. The ammonia, in the form of a hot gas, is compressed to 150–175 lb. per square inch by means of a pump (called the compressor), and discharged into a series of coils (the condenser), which are kept cool by external spraying with cold water, causing the gas to be condensed into a liquid, which flows into a storage tank. The liquid ammonia is then expanded through a valve, which reduces its pressure and produces intense cold. During this process the ammonia evaporates, i.e. becomes gaseous, is drawn into the compressor again, and continues to go through the same cycle as long as the compressor is working.

There are three methods by which the chambers are cooled, viz. (1) *direct expansion*, (2) *brine circulation*, (3) *air circulation*.

(1) In the *direct expansion* method the liquid ammonia is expanded in coils of pipes, placed on the roof or sides of the insulated chambers; the heat of the chamber and its contents is thus absorbed directly by the expanded ammonia in the coils, and the temperature within the chamber is reduced.

(2) In the *brine circulation* method the ammonia is expanded in coils, which are surrounded by liquid brine (a mixture of water and common salt or chloride of calcium, having a very low freezing-point) reduced in temperature, and pumped through coils in the insulated chambers. The cold brine, having absorbed the heat, returns to the ammonia coils to be recooled.

(3) In the *air circulation* process the ammonia is again expanded into coils; air is drawn over these coils by powerful fans, cooled by contact with the cold coils, and discharged through trunks into the insulated chambers, returning again to be recooled.

Refrigerated ships carrying perishable cargoes are generally fitted with the brine or air circulation, the medium used being carbonic dioxide (CO_2) instead of ammonia. Fruit and vegetables are chilled, not frozen, being kept at a temperature of 33° to 45° F. Decay in fruit is prevented, and the action of bacteria is retarded. Meat and poultry to be chilled are kept at or about 30° F., and will keep up to forty days at this temperature. Mutton, beef, fish, poultry, &c., are kept at 5° to 18° F., and can be preserved in good condition up to three or four years. Careful handling and a steady temperature are of the utmost importance for preserving produce in good condition.

Ice Manufacture.—All refrigerating machines can also be adapted for ice-making. The methods generally adopted are the *can* and the *cell* system, the former being the more convenient and popular.

In the *can* system a large tank is provided for liquid brine, which is reduced in temperature, as explained under *brine circulation*. In this liquid brine are placed sheet-iron cans filled with water. The intense cold of the brine round these cans of water causes the water to freeze until it is solid ice. The cans of ice are now lifted out of the brine and placed in a tank of warm water for a few minutes, so that the ice thaws away from the warm sides of the cans. The cans of ice are now lifted from the warm water and tilted, when the ice slides out in a solid block.

The *cell* system consists of a large wooden tank partitioned off into compartments by hollow iron walls, which are called the cells, the water to be frozen being contained between these cells. Cold liquid brine is circulated through the cells, thus causing the water between them to be frozen. When the ice is solid, hot brine is pumped into the cells, causing the ice to thaw off the sides, when it is lifted out in solid blocks.

The brine in both systems is generally reduced to a temperature of 12° to 15° F. Whilst the water is being frozen it must be kept in motion, otherwise the ice would be like frozen snow, white and opaque. A favourite method of keeping the water in a state of agitation during freezing is by blowing compressed air at 5 to 10 lb. pressure into it, all the air and foreign matter held in suspension being thus separated from the water, so that the ice obtained is transparent and beautifully clean. The ice is made in convenient shapes from ½-cwt. to 5-cwt. blocks, and is from 6 inches to 12 inches thick, the latter taking from forty-eight to sixty hours to make.

Previous to 1914 considerable quantities of natural ice were imported from Norway into this country, but now that the manufacture of artificial ice, which is much superior to natural ice, has reached a state of perfection, importation has ceased.

Ice′ni, a warlike tribe of ancient Britain, occupying the modern counties of Suffolk, Norfolk, Cambridge, and Huntingdon. They fought against the Romans under their queen Boadicea (A.D. 61).

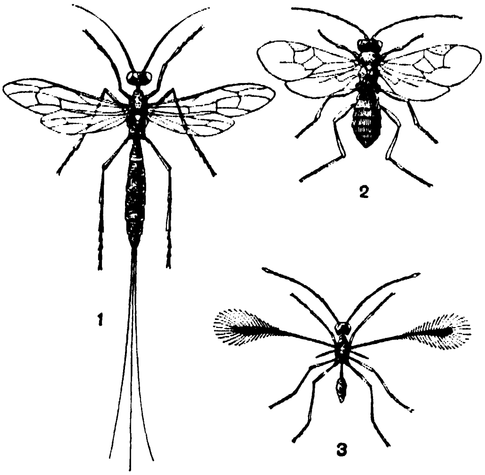
Ice-plant (*Mesembryanthĕmum crystallĭnum*), a plant (ord. Ficoideæ) which has received the above name from the transparent vesicles (water-storing cells) which cover its whole surface, and have the appearance of granules of ice. It is a native of South Africa and the Canaries, and is also found in Greece.

Ichang, or **Echang**, one of the treaty ports of China, province of Hupeh, on the Yangtze, about 1000 miles up, the river being navigable all the way, but presenting difficulties above the city. There is a considerable traffic in European goods. A railway from Ichang to Kweichow is being constructed. Pop. 55,000.

Ichneu′mon (Herpestes), a genus of digitigrade carnivorous mammals belonging to the civet family. They have a long slender body, a sharp and pointed muzzle, and short legs. The most celebrated species, ***Herpestes ichneumon***, inhabits Egypt, where it is called ***Pharaoh's rat***. It was worshipped by the ancient Egyptians on account of its antipathy to crocodiles, whose eggs it digs out of the sand and sucks. It is expert in seizing serpents by the neck so as to avoid any injury to itself. It is domesticated in Egypt, and more useful than a cat in destroying rats and mice. Its disadvantage as a domestic animal is its predilection for poultry. The mongoose, or Indian ichneumon, is another species, not so large as the Egyptian, which it resembles in habits, being kept in many families as a useful domestic animal. The suricate or meer-cat of South Africa (*Suricata tetradactyla*), closely related to the ichneumons, is more robust in build and largely vegetarian.

Egyptian Ichneumon, or Pharaoh's Rat
(*Herpestes ichneumon*)

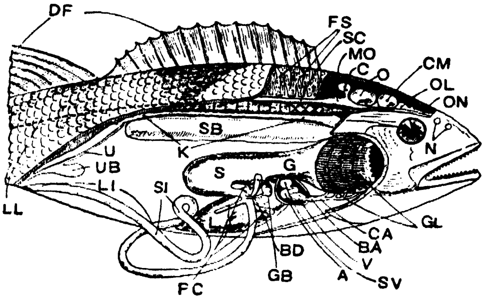
Ichneumon-flies, a large family of hymenopterous insects, which all agree in one particular, that they deposit their eggs either in or on the bodies, eggs, or larvæ of other insects. These apparently insignificant creatures confer inestimable benefits on man, as they destroy hosts of insects injurious to crops.



Ichneumon-flies

1, *Rhyssa persuasoria.* 2, *Microgaster glomeratus* (parasitic on the Cabbage White Butterfly larva). 3, *Mymar pulchellus.* All enlarged.

Ichthyol′ogy, the study of fishes, which constitute the lowest class of vertebrates in which jaws are present. It is sometimes, however, extended to include the lampreys and hags (q.v.), as the ord. Marsipobranchii (pouched gills), but these are now usually placed lower in the scale and grouped in a special class, Cyclostomata (round mouths). They are scaleless eel-shaped forms, differing from true fishes in the absence of jaws and paired fins. Pisces, or fishes proper, are jaw-bearing vertebrates adapted in various ways for life in water. Swimming is usually effected by lateral movement of a well-developed tail, and balance is maintained by fins, thin expansions of the body supported by jointed rods (fin-rays), and either unpaired or paired. The former are in the median vertical plane, and comprise dorsals, caudal (round the tail), and anal. The *caudal fin* is usually either asymmetrical in structure and external form (heterocercal) or symmetrical externally (homocercal).



DF, Dorsal fins. FS, Fin supports. SC, Spinal cord. MO, Medulla oblongata. C, Cerebellum. CM, Cerebrum. O, Optic lobe. OL, Olfactory lobe. ON, Olfactory nerve. N, Nostrils. SB, Swimming-bladder. U, Ureter. UB, Urinary bladder. S, Stomach. G, Gullet. LI, Large intestine. SI, Small intestine. L, Liver. LL, Lateral line. PC, Pyloric cæca. BD, Bile duct. GB, Gall bladder. G, Gills. CA, Central aorta. BA, Bulbus arteriosus. V, Ventricle. SV, Sinus venosus. A, Auricle

The paired fins are pectoral and pelvic, corresponding to the fore- and hind-limbs of land vertebrates. The former are important for steering purposes. The skin is more or less slimy, and usually provided with scales, which vary greatly in character, and may be tooth-like (dermal denticles), or strong bony plates, or thin, flexible, and overlapping. A peculiar streak, the *lateral line*, is generally present on each side of the body, and this is associated with special sense-organs related to an aquatic life. The breathing organs are *gills*, delicate vascular outgrowths from the walls of gill-clefts by which the pharynx communicates with the exterior. In all but lung-fishes the heart possesses but one auricle, and contains only impure blood, which is pumped through the gills, where it is oxygenated, and then to the general body. In many fishes there is a swim-bladder, the primary use of which is to act as a float, but in some cases it helps in breathing. Fishes are predominatingly oviparous, and in most cases the eggs are fertilized externally.

Fishes are classified as follows: Order I—Elasmobranchii. Scales as spiny plates resembling teeth in structure. Tail usually heterocercal, and mouth on under side of head. Gill-slits open directly to exterior, and not protected by a gill-cover. No swim-bladder. A few are viviparous, but most are oviparous, laying eggs contained in horny cases. Fertilization internal. (1) Selachii. Sharks and dog-fishes. Examples: Spotted dog-fishes (Scyllium); tiger- or zebra-shark (*Stegostoma tigrinum*) of Indian Ocean, marked with dark bands on yellow ground; blue shark (*Carcharias glaucus*) of Atlantic and Pacific, and attaining a length of 25 feet—an allied species (*C. nicaraguensis*) lives in Lake Nicaragua; topes (Galeus); hounds (Mustelus); hammer-head sharks (Sphyrna); porbeagles (Lamna); thresher shark (*Alopecias vulpes*); basking-sharks (Cetorhinus), northern forms that attain the length of 40 feet; Rhinodon, with minute teeth, a harmless shark that may exceed 50 feet in length; piked dog-fish (Acanthias); Greenland shark (*Læmargus borealis*); angel-shark or monk-fish (*Rhina squatina*). (2) Batoidei, with body more or less flattened from above downwards. Examples: Saw-fish (*Pristis antiquorum*); rays or skates (Raia); electric-ray (Torpedo); sting-ray (Trygon); eagle-rays (Myliobatis, &c.).

Order II—Holocephali. A small group resembling preceding, except in the characters of the skeleton. Almost scaleless, but a strong spine in front of the first dorsal fin. A membranous gill-cover. Chimæra, Callorhynchus, Harriotta.

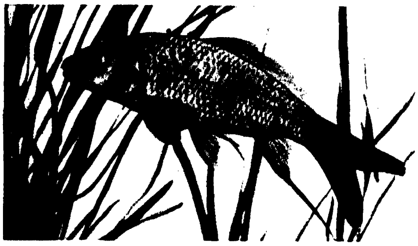
Order III—Teleostomi. Bony fishes, usually with swim-bladder and terminal mouth. Gill-cover, supported by bones. (1) Crossopterygii. Paired fins covered with scales at their bases. Include the two freshwater African forms, bichir (Polypterus) and reed-fish (Calamoichthys). (2) Actinopterygii. Paired fins not scaly at the base. (*a*) Ganoidei. Mostly inhabit fresh water. Tail heterocercal. Sturgeons, with ventral mouth, large bony plates in skin (Acipenser and Scaphirhynchus) or largely scaleless (Polyodon and Psephurus). Bow-fin (Amia), with terminal mouth, and thin overlapping scales. Bony pikes (Lepidosteus), with armour of rhomboidal bony plates covered with enamel, and much elongated jaws. (*b*) Teleostei. Tail homocercal. Includes the great bulk of bony fishes, such as salmon, cod, and sole. (See *Teleostei*).

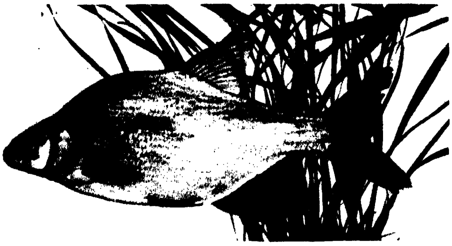
Order IV—Dipnoi. Freshwater bony forms in which the swim-bladder is used for breathing air. African lung-fish (Protopterus), South American lung-fish (Lepidosiren), Australian lung-fish (Neoceratodus).—BIBLIOGRAPHY: *Cambridge Natural History*; Sir E. Ray Lankester, *Treatise on Zoology*; Gunther, *Study of Fishes*; Dean, *Fishes, Living and Fossil.*

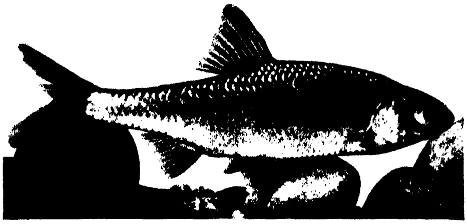
Ichthyor'nis (Gr. *ichthys*, a fish, *ornis*, a bird), a fossil genus of carnivorous and probably

ICHTHYOLOGY: FRESH-WATER FISHES

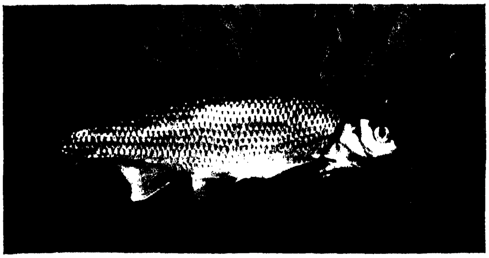
Barbel

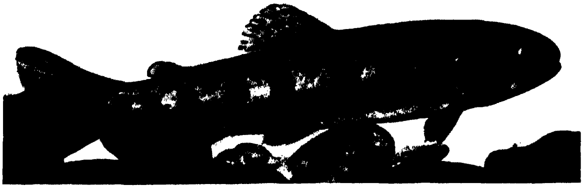

Common Carp


Silver Bream


Roach

Chub


Dace


Rainbow Trout

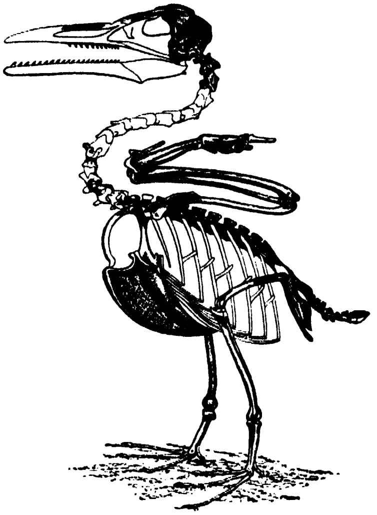
Perch

Gudgeon

Pike

[illegible]

aquatic birds, one of the earliest known birds, found in the Middle Cretaceous beds of Kansas. It is so named from the character of the vertebræ, which are biconcave, like those of fishes and many fossil reptiles. Its jaws have teeth set in separate sockets; but the limbs are bird-like and the wings are well developed. Its size was that of a pigeon.



Ichthyornis (after Marsh)

Ichthyosau'rus (Gr. *ichthys*, a fish, *sauros*, a lizard), an immense fossil marine saurian or reptile, having an organization combining the characters of saurian reptiles and of fishes. The external form, with a dorsal fin and caudal lobes, is now known from impressions in the Jurassic beds of Württemberg. The members of this genus had four broad feet or paddles enclosed in a single sheath of integument, and a long and powerful tail, the vertebral column being continued into the lower lobe. Some of the largest of these reptiles must have exceeded 30 feet in length. Their remains range from the Trias of Southern Germany to the Upper Cretaceous, and the great British repository hitherto has been the Lias at Lyme Regis.

Ichthyo'sis (Gr. *ichthys*, a fish) is a disease of the skin characterized by an overgrowth of the horny layer of the epidermis. The skin thus becomes thickened, and is rough, dry, and scaly. Some parts of the skin are more affected than other regions, but the whole skin shows dryness and scaliness. The disease appears during the first year, and increases in severity from the fifth to the fifteenth, when it becomes stationary, persisting throughout life. The ichthyotic skin is very vulnerable; chapping takes place easily, and outbreaks of eczema are common. Treatment is purely palliative. No drugs have any definite influence, but local treatment is important in the form of alkaline baths to remove the scales, and the application of glycerine or oily substances to keep down the scaliness and to lessen the roughness.

Icon'oclasts (Gr. *eikonoklastai*, image-breakers), the party in the early Christian Church that would not tolerate images, much less the adoration of them. At first images of martyrs and bishops were placed in the churches merely to keep their memory fresh, but in the sixth century they began to be worshipped, lights being burned before them and incense offered in their honour. The Eastern emperor, Leo III, issued an edict in A.D. 726 ordering the people to abstain from the worship of such images, and soon after he decreed their destruction. This caused great commotion, and there arose two parties in the Church, the image-worshippers and the *Iconoclasts* or image-breakers, who each in turn persecuted the other. In 754 a council at Constantinople condemned image-worship; in 787 the second Council of Nice (Nicæa) asserted and defined the doctrine. The controversy lasted over a century, coming to an end when, under the Empress Theodora, a council held at Constantinople (842) declared in favour of the worship of images among the Greeks, a decision which was confirmed by a second council, held 869–870, in the same place. In the Western Empire also images were at first retained only to preserve the memory of pious men, but the decision of the Pope, which allowed the worship of images, finally prevailed in the Western Church. See *Iconolatry*.—BIBLIOGRAPHY: J. B. Bury, *A History of the Later Roman Empire*; L. Bréhier, *La Querelle des Images*.

Iconol'atry, the worship or adoration of the images of sacred personages connected with the Christian religion, as images intended to represent angels, the Virgin Mary, saints, martyrs, &c. Iconolatry must not be confounded with idolatry, which worships objects as being themselves divine or possessing supernatural power. The worship or adoration of images was not common in the Church for several centuries after Christ, and in its earlier stages it excited strong feelings, especially in the Eastern section of the Church. (See *Iconoclasts.*) The second Council of Nicæa taught that images were to be retained, but that they were not to be objects of adoration in the strict sense, though it was right to salute, honour, and venerate them, and to burn lights and incense before them. This decree was rejected by Charlemagne and by a council at Frankfurt in 794, but the practice of image-worship finally established itself in the West. Roman Catholics maintain that the cultus of images is 'relative', and that they are not in themselves really adored or honoured, 'but that all adoration and veneration is referred to the prototypes, inasmuch as images have no dignity or excellence to which such honour properly appertains '.

Icter'idæ, a family of American passerine birds, allied to the finches, remarkable for the hammock-like nests which they construct, and hence called *hangnests*. The Baltimore bird (*Icterus baltimorii*) may be regarded as typical.

Ida, in ancient geography: (1) A mountain range in the Troad (Mysia), at the foot of which lay the city of Troy. Its highest peak was Gargarus, about 4650 feet. (2) The middle and highest summit of the mountain chain which divides the Island of Crete from east to west. This peak affords a fine prospect, and is covered with woods of pine, maple, and cedar.

I'daho, one of the United States of America, in the Mountain Division, and situated on the western slope of the Rocky Mountains, having Montana and Wyoming on the east, and Washington and Oregon on the west; land area, 83,354 sq. miles. Pop. 431,866. Idaho owes its rise and importance to its rich gold-fields, previous to the discovery of which, in 1860, and subsequently, it was inhabited only by Indians. The surface is largely mountainous, the highest summits rising to 12,000 and 13,000 feet. In the centre of the state are the Salmon River Mountains, to which belongs the picturesque and lofty Saw-tooth Range. The chief rivers are the Lewis or Snake River and the Salmon River, the latter a tributary of the former, which again joins the Columbia. Along the course of the Snake River in the south-east and south is a desert tract 400 miles long by 40 to 60 miles broad. There are valuable forests, but they extend only over a small area. The scenery along the Salmon River in some places is grand, the stream flowing between perpendicular walls of rock from 500 to 2000 feet high. Gold has been found in many places, and there are also valuable silver-mines, gold and silver being produced to the value of about 7,000,000 dollars annually. Coal, copper, iron, and salt are likewise found in many localities. The wild animals include the grizzly bear. The higher mountain ranges are bleak and barren, but the lower hills are generally well wooded, and the soil of the valleys is productive. In general the surface is better adapted for grazing than for cereal raising. Boisé City is the capital. Pop. (1920), 21,393.

Id'desleigh, Stafford Henry Northcote, first Earl of, English statesman, born 1818, died 1887. He was educated at Eton and Balliol College, Oxford, where he gained high honours; became private secretary to Gladstone in 1842, and was called to the Bar in 1847. In 1851 he succeeded his grandfather in the family baronetcy. He held various offices, and represented several constituencies as a Conservative, being long member for North Devon. He published a treatise, *Twenty Years of Financial Policy*, in 1862. He was one of the Commissioners to the United States in 1871 to arrange the *Alabama* difficulty. After being Secretary for India (1867–8) and Chancellor of the Exchequer (1874–80) under Disraeli, upon the elevation of the latter to the peerage he became leader of the Lower House, his task being all the more difficult owing to parliamentary obstruction. He was elected Lord Rector of Edinburgh University in 1883. In 1885, when Gladstone was succeeded by Lord Salisbury, he was created Earl of Iddesleigh, and became First Lord of the Treasury, being Foreign Secretary in the next Salisbury Cabinet.

Ide, a fish of the carp family (Cyprinidæ), the *Leuciscus idus*, found in rocky lakes of Central and Northern Europe. It is a good table-fish, which might be introduced into British waters. A gold-coloured German variety is known as the orfe.

Idea (Gr. *idea*, from *idein*, to see; Lat. *idea*, kind, form). The philosophical term idea was introduced by Plato, who designated by it the perfect and eternal models, the prototypes, essence, and archetypes of individual, sensible objects, which are only the images of the ideas. According to Plato, ideas constitute the essence and the types of sensible objects, and have their existence not only in our minds, as abstracts of concrete things, but separately and independently outside our minds. Ideas are perfect and immutable, not being subject to that change which individual objects usually undergo. In modern philosophy the term idea has a different meaning. It designates the image and conception which the human mind forms of an object. An idea is thus the *conception* of the object, as distinguished from the object itself. According to Descartes, idea means " all that is in our minds when we conceive a thing ", whilst Locke applied the term idea not only to a concept of the intellect, or an image of the imagination, but also to " that which the mind is employed about, when thinking ". As to the origin of ideas, some philosophers are of opinion that they are derived solely from experience, whilst others maintain that reflection upon experience (i.e. the help of reason) is also necessary to supplement our knowledge. According to Leibnitz, all ideas are *innate*. See *Idealism*.

Ide'alism, in philosophy, is the theory which teaches that all material objects are only ideas in some mind, and that the subjective or ideal existence is not only the original but the only true being. According to this theory only a phenomenal existence is allowed to sensible objects, an existence which is dependent upon the mind of a thinking subject.

Idealism may be considered metaphysically and epistemologically. Metaphysically idealism teaches that not inanimate matter but intellectual principles are the really existent, that the world throughout is the work of the embodiment of reason or mind. The diametrical opposite of this idealism is materialism, which maintains that ' the universe is simply a brute fact, or a collection of brute facts under the sway of mechanical laws '. The oldest system of idealism is that of Plato. He maintained that ideas have a real existence, and are the prototypes of all phenomena. All true being he placed in the divine ideas, of which sensible objects are only copies in the element of the non-existent, and accordingly have in themselves merely a phenomenal or apparent existence. In modern philosophy metaphysical idealism has been developed in the systems of Fichte, Schelling, and Hegel.

Epistemological idealism, which belongs entirely to modern philosophy, is the theory which, in contradistinction to *realism*, teaches that ' perceptions of things ' and ' things in themselves ', that ' thought ' and ' existence ', or ' reality ', are widely different. Realism teaches that things are exactly so in reality as they appear to us through the medium of our perceptive faculties. The world ' without ' is as real as, and exists independently of, our consciousness which perceives it. In contradistinction to this doctrine, idealism maintains that knowledge is not at all the perception of things as they really are—the exact copy and repetition of things in themselves —but as they appear to us. Knowledge being an inner psychical process, there can be no similarity between it and the things ' without '. The world around us is only the product of our mind. Whilst the realist considers that in sense-perception we have a certainty and a guarantee of the reality of existence, the idealist is of opinion that ' the only reality of the external world is its perceptibility '. Descartes, Malebranche, Leibnitz, Spinoza, and Kant are idealists to a certain extent. Descartes and Kant, however, are not pure idealists, inasmuch as they allow at least a problematical existence to sensible things as independent of the thinking subject.

The real founder, however, of modern idealism was Berkeley (q.v.), who maintained that what is called matter consisted merely of what he called ideas, that is, appearances produced in the mind by the direct influence of the Deity. This dogmatic idealism of Berkeley differs from the critical or transcendental idealism of Kant, who taught that all the material of experience is given in sensation, but, on the other hand, the forms of the experience (space, time, and the categories of the understanding) arise in ourselves a priori, and that accordingly sensible objects are known only as they appear to us and not as they are in themselves.

Idealism in æsthetics is the opposite of naturalism or realism. Naturalism in art is the theory which maintains that the aim and purport of art consists in the imitation of nature, or, at least, in the endeavour of the artist to approach as nearly as possible to nature. In contradistinction to this theory, idealism teaches that if the artist copies, he also modifies nature at the same time. He selects and recombines, thus bringing out immanent meanings and interpretations. He conceives an ideal and produces it, blending reality with his own thoughts and sentiments. See *Philosophy*.

Iden'tity (Lat. *idem*, the same) is a philosophical term applied to the sense, which every one of us possesses, of being the same individual to-day as yesterday and the preceding days, i.e. of continuing our personality. We discover in ourselves, in our personality, an indefinable something, an ego, or an I, which remains the same under various and varying circumstances. Thus personal identity is the continuity of personal existence, our being the same persons from the beginning to the end of life. It is upon this feeling that Descartes and other philosophers based their dualistic theory of body and soul, and of the spiritual nature of the latter. The body undergoes continual changes, but the soul remains the same.

Under the principle of identity (in logic) we understand the condition of remaining constantly the same. As long as it has not been subjected to modification a thing remains the same; it *is what it is*. This principle is expressed in the formula of $A = A$, or the same is the same. Derived from and connected with this principle are the principles of contradiction: (1) that a thing cannot at the same time be itself and something else; (2) that it must be one thing, or another; and (3) that between a thing and its opposite there can be no middle term. The philosophy of Schelling was called by himself the Philosophy of Identity, as teaching the identity of thought and being.

Identity of person in point of law must often be proved in legal proceedings, as in proving a thief, &c. The usual proof is the oath of one who was cognizant of the facts at the time referred to. A common defence of persons accused of crime is that it is a case of mistaken identity, in which case the prisoner must usually prove an *alibi*—i.e. that he was in some other place at the time specified. See *Beck Case*.

Idiocy is the term applied to a condition of defective development of intelligence usually associated with an arrest of the development of the brain. Thus anything that interferes with the normal growth of the brain, such as premature closure of the sutures of the skull, injuries to the brain itself, or disease affecting it either before birth or before the intellectual powers have been acquired after birth, may cause idiocy. Chronic alcoholism or syphilis in the parents may so affect the germ plasm or the tissues of the growing embryo that the development of the brain becomes impaired. Other diseases in the mother, as well as exhaustion from too frequent child-bearing, or other factors of a mechanical or chemical nature that interfere with the proper nutrition of the developing child, may impair the growth of the brain so as to produce mental deficiency. Any influence after birth that impairs the normal unfolding of the child's mind may result in idiocy. Injuries to the brain, hæmorrhage, inflammation, the interference with the drainage of the cerebro-spinal fluid, causing hydrocephalus, are among the causes that often lead to a destruction of cerebral tissue and an impairment of the budding intelligence. Epilepsy and tubercular meningitis are prone to result in mental impairment. If early in life a peculiar gland in the neck, known as the thyroid, is injured or destroyed by disease, a special form of idiocy known as cretinism results.

Every gradation of idiocy may occur, from a total absence of any sort of intellectual control of the animal functions to such slight impairments as defective memory and inability to concentrate the mind or fully to exercise self-control. Idiocy is often associated with deformities of the body due to defective growth, and some of the signs of a lack of intellectual control are dirty habits and indecent behaviour. Nothing can be done in extreme cases (where there is no obvious cause that can be removed) other than the most assiduous and sympathetic supervision and care. But the less severely affected patients can be taught (in special schools with patient and devoted teachers) habits of cleanliness and obedience, and also in some cases useful work of a simple mechanical kind.

The lack of self-control makes idiots, both boys and girls, a special danger to the community, from their aptitude to give free rein to their sexual instincts. The danger lies not merely in their own vicious practices, but also in the fact that they may produce new generations of potential criminals and evil-livers. Thus even when idiots are not really a danger to themselves or an offence to those with whom they live, confinement in a proper institution is in most cases desirable to prevent them from indulging their sexual passions and procreating dangerous members of society.—BIBLIOGRAPHY: N. H. Goddard, *Feeble-mindedness*; C. P. Lapage, *Feeble-mindedness in Children of School Age*; E. B. Sherlock, *The Feeble-minded*; T. Ribot, *The Psychology of Attention*; Sollier, *Psychologie de l'idiot et de l'imbécile.*

Idiosyn'crasy, a distinctive peculiarity of the mental or bodily constitution of any person, or that constitution or temperament which is peculiar to any person. The term sometimes corresponds with *antipathy* (q.v.). In medicine it is applied to the unusual reaction of a person to food, drugs, or any kind of stimulus. Thus a dose of quinine that would produce no obvious effect on most people may cause the most profound disturbances in others. Certain kinds of healthy food may also upset some individuals.

I'docrase, or **Vesuvianite**, a mineral crystallizing in square prisms of the tetragonal system, commonly occurring as brownish aggregates. It is a basic calcium aluminium silicate, and commonly arises in limestone altered by contact with igneous masses.

Idol'atry, the use of idols or images supposed to represent the deity, or rather some particular god or goddess, for purposes of worship or religious appeal in its widest sense. The interest of the study of idolatry is enhanced by the realization of the fact that it represents a phase through which all the higher religions passed in the course of their development, not excluding those which insist upon the repudiation of idols as one of the cardinal tenets of their belief. To appreciate the significance of idols it must be remembered that the fundamental conception underlying all religions is the quest of life and the averting of death. At first the search for 'a giver of life' aimed at discovering some elixir which would rejuvenate the individual and postpone death, if it did not avert it altogether; but eventually, when it was realized that death was the inevitable fate of every living creature, the aim of religion was to secure the prolongation of existence after death and the attainment of immortality, which in the more primitive religions was the exclusive privilege of the gods and the chief distinction between gods and men. The original life-giving amulet seems to have been the cowrie shell, because it was regarded as a model of the reproductive organs of women, whence all life was derived. Then models of the cowrie were made for use as life-giving and death-averting amulets. Then these amulets were personified and converted into what are erroneously called 'steatopygous' figurines, under the belief that the early women were modelled like those of the Hottentot race; but they are really models of cowries to which crude representations of the head, trunk, and limbs have been added as a concrete expression of the identification of the life-giving amulet with the Great Mother, who was regarded as the creator and giver of life to the whole universe.

The next phase in the development of idolatry arose from the Egyptian custom of making portrait-statues of a deceased king, queen, or noble, which (so it was believed) could be converted in the most literal sense of the term into ‘a living image’; it could be reanimated and could listen to the requests of supplicants. As the original god (Osiris) was merely the dead king, who was believed to control all the processes of life-giving and prosperity-giving in his dominions, the earliest form of masculine idol was a model of the dead sovereign in stone, clay, or metal, which was animated by appropriate procedures, and was then supposed to be able to hear and grant the appeals made to him by his former subjects through the intermediation of the ruling king, who *ipso facto* was the high priest. The great boon which the earliest deity was believed to give was an adequate water-supply for agriculture, either a good inundation or beneficent rain. The idols of both the male and the female deities assumed a bewildering variety of forms, as they were identified with many animals, such as the cow or ox, the pig, the lioness or lion, the eagle or falcon, the sheep or goat, &c. But the conception underlying all idolatry was the granting of life-giving or death-averting boons. For bibliography see G. Elliot Smith, *The Evolution of the Dragon*, Manchester, 1919.

Id′ria, a town of Italy, in the province of Udine, formerly (before the European War) in the Austrian province of Carniola, 21 miles south-west of Laibach. It is celebrated for its mines of quicksilver, which, after those of Almaden in Spain, are the richest in Europe, and employ in mining and smelting about 1300 persons. Pop. 6100.

Idumea. See *Edom.*

Idun, or **Iduna**, a goddess in the Scandinavian mythology, wife of Bragi, keeper of the apples of which the gods ate to keep themselves young.

I′dyll (from Gr. *eidyllion*, a ‘little image’) is the name originally and still most usually applied to a short and highly-finished descriptive poem, especially if it treats of pastoral subjects, though this last circumstance is not an essential character of the idyll. All that is necessary to constitute a poem of this class is that it presents to view a complete picture in small compass. The term was originally applied to the poems of Theocritus, Bion, and Moschus, but it has been loosely used by many writers, and the idyll can hardly be said to be a definite literary form.

Ieisk, or **Yeisk**, a seaport of Kūban, Russia, on the Sea of Azov. It was laid out in 1848 on a sand-bank, and rapidly increased. It now has tanneries, tile-works, oil-mills, and soap-works. Pop. 29,529.

Ieletz, or **Yeletz**, a town of Russia, government of Orel, at the confluence of the Ieletz and Lutchka. It has flourishing manufactures, and an extensive trade. Pop. 30,540.

Iesi, or **Jesi** (yä′sē), a walled town of Italy, in the province of Ancona, 17 miles s.w. of Ancona. Pop. 14,500.

If, a small island near Marseilles, on which is the Château d'If (built by Francis I about 1530), formerly a French State prison. The Château d'If figures in the masterpiece of Dumas père, *Le Comte de Monte-Cristo.*

Ig′lau, an old town, formerly in Austria, now belonging to Czecho-Slovakia. It is now known as *Iglawa*, and is the largest town in Moravia next to Brünn, on the Iglawa, 49 miles W.N.W. of Brünn. The staple manufacture is woollen cloth. Pop. 25,000.

Iglesias, a walled town of Sardinia, in the provinces of Cagliari. In its vicinity are lead, zinc, and other mines. Pop. 22,000.

Ignatiev, Nicholas Paulovitsh, Russian soldier and diplomatist, born in St. Petersburg (Petrograd) in 1832, died in 1908. He served in the Crimean War, and was made a colonel in 1856. In 1858 he was sent on a special mission to Bokhara and Khiva, and proceeded as an Ambassador to Peking in 1860. He was appointed minister at Constantinople in 1864, and was envoy extraordinary from 1867 to 1878. He was conspicuous in the negotiations before and after the Russo-Turkish War, and was appointed Minister of the Interior, but was dismissed in 1882. He represented the party in favour of war, in opposition to Prince Gortschakov. He was subsequently made Governor-General of Irkutsk.

Ignatius, St., Bishop of Antioch, one of the Apostolic Fathers, said to have been a disciple of the Apostle John. His life and death are wrapped in fable. According to the most trustworthy tradition, he was appointed Bishop of Antioch A.D. 69, and was thrown to wild beasts in the circus of Antioch by the command of Trajan, the date being given by some as A.D. 107, by others as A.D. 116. By the Greek Church his festival is celebrated on 20th Dec., by the Latin on 1st Feb. In the literature of the early Christian Church Ignatius holds an important place as the reputed author of a number of epistles. These have come down to us in three forms. In the longest text they are thirteen in number, but since the discovery of a shorter text containing only seven the first has been universally recognized as in great part spurious, some of the letters entirely so, and others containing interpolations But even in this shorter form their genuineness has been disputed by numerous scholars. Both of these texts are in Greek, but a still shorter text in the Syriac language, containing only three letters, exists. Some maintain that the Syriac text was the earliest, though not earlier than the middle of the second century. Others hold the genuineness of the shorter Greek text.

Ignatius, St., Patriarch of Constantinople, son of the Emperor Michael I, was born about A.D. 798, died in 878. When his father was deposed he entered a monastery, assuming the name of Ignatius. In 846 he was raised to the patriarchate. He was opposed to the Iconoclasts, and his refusal to admit Bardas, brother of the Empress Theodora, as a communicant, on account of his reported immorality, led to his deposition in 857. The schism between the Greek and Roman Churches began while Photius, his successor, was in office, and has continued ever since. He was reinstated in 867, and at an œcumenical council assembled at Constantinople in 869 Photius and his party were condemned.

Igneous Rocks (Lat. *ignis*, fire), rocks that have been at some time molten in the earth's crust, and that have consolidated in subterranean cauldrons, or as dykes filling cracks up which they have been forced, or as lava-flows and exploded fragmental accumulations at the surface. They consist almost entirely of silicates, with a few oxides, such as those of iron, titanium, and chromium. The observation of igneous rocks naturally began amid the stimulating if alarming phenomena of volcanoes, and it was long before the great sheets of basalt, cut off from their parent sources by denudation, or the masses of granite that send off veins into surrounding rocks, were recognized as truly igneous. The controversy between *Neptunists*, who adopted the view of Werner that basalts were sedimentary and that the crystals of granite had separated from aqueous solution, and the *Vulcanists*, led by Hutton, who maintained the efficacy of internal heat, raged fiercely at the close of the eighteenth century; and, if the Vulcanists were triumphant, it must be admitted that occluded water has much to do with the phenomena of molten masses in the crust. This water escapes, with various gases, from lava-flows, and its expansion and passage into steam play a large part in volcanic eruptions. The association of water and gases no doubt assists the subterranean molten masses to corrode the walls of their cauldrons and to make a place for themselves among the superincumbent rocks. Igneous rocks often occupy the core of mountain chains, where the arching of strata has allowed of their rise, assisted by the general pressure, from the depths; but they extend their domain by 'stoping' off blocks from the cover, and they work their way upwards by prolonged and insidious attack.

At the surface or in thin veins they may cool with comparative rapidity, and the crystallization of their constituents is here on a minute or partial scale. A certain amount of glass may even remain in the interstices of the crystalline mesh. But an igneous mass may be maintained in the depths for a very long time at a temperature that allows of the separation of this or that constituent, and the resulting rock is then coarsely crystalline. Every stage may be traced, from granites with crystals of felspar 5 feet long, or of mica 9 feet in diameter, to the fine-grained materials of dykes, or the lavas whose structure requires elucidation by the microscope.

The range of composition in igneous rocks is not a wide one, and it is probable that the varieties have been produced by *differentiation* from an original fairly uniform magma, with the aid of material absorbed from the crust in the upward movement of the molten masses. On the supposition that these masses come from a region of the interior where rocks of the composition of basalt prevail, minerals poor in silica, and rich in magnesium and iron, such as olivine, may separate during cooling and sink towards the floor of an igneous cauldron, leaving a magma more rich in silica, potassium, and sodium in the upper layer. This magma may become still more siliceous by assimilating matter from the outer crust as it ascends, and highly siliceous igneous rocks may ultimately reach the surface. Where volcanic vents lead down into the greater depths, or where some fissure taps the lower part of a cauldron, the magma rich in magnesium and iron flows up, and its greater fusibility and mobility may produce lava-flows that, age after age, deluge thousands of square miles of country.

Igneous rocks have formed a special study, carried out with great minuteness of classification; but the percentage of silica may be taken as the broad basis of grouping, and within each group structure may be used for subdivision. The old terms *acid* and *basic* have been used for the groups with some 70 per cent and 45 per cent of silica respectively, and a large *intermediate* group lies between them. Granite, consisting of quartz, potassium felspar, and mica, is the type-rock of the acid group, and olivine-gabbro, consisting of felspar rich in calcium, pyroxene, olivine, and iron-titanium ores, is the type-rock of the basic group. It may be convenient to arrange the common igneous rocks as in the table on the following page.

In reading older treatises, we must remember that in Germany, where classification by carefully defined characters has sometimes obscured natural alliances, a sharp division was at one time made, under the influence of H. Rosenbusch, between Cainozoic igneous rocks and those older than the Eocene period. This view spread in France, Italy, and even in the United States, but at no time prevailed in the British Isles, where the 'uniformitarian' principles enunciated by Hutton and Lyell caused stress to be laid on

	Granite Group.	Syenite Group.	Diorite Group.	Olivine-gabbro Group.
Coarsely crystalline ..	Granite	Syenite	Diorite and gabbro	Olivine-gabbro
Finely crystalline ..	Compact granite (quartz-felsite, &c.)	Compact syenite	Compact diorite (aphanite and dolerite)	Olivine-dolerite
With some traces of glass	Rhyolite	Trachyte	Andesite and basalt without olivine	Olivine-basalt

the resemblances rather than on the differences of rocks formed in successive periods. It was pointed out, especially by J. W. Judd (1876 and onwards), that the more glassy types of igneous rocks could be traced in denuded volcanic areas into crystalline masses that had consolidated slowly underground. The highly crystalline rocks that are best known to us are naturally ancient, since those of later date commonly remain unexposed; but Judd showed that in Hungary and the Inner Hebrides there were granites, diorites, and gabbros of Cainozoic age. The absence of glassy lavas from the majority of ancient volcanic areas is due to the readiness with which glass becomes crystalline in the course of geological time. Since the opening of the twentieth century, the factor of age has been happily discarded from the nomenclature of igneous rocks, and it is recognized that there has been no evolution of new characters among them during the long ages covered by stratigraphical geology. See *Geology*.

Ignis Fat′uus (Lat., ‘ foolish fire ’), a luminous appearance seen floating over marshy places at night, and sometimes, it is said, in churchyards. It is probably due to some gaseous mixture capable of igniting spontaneously, but it has never been satisfactorily explained. Other names are *Will-o'-the-wisp* and *Jack-a-lantern.*

Ignition, the act of raising the temperature of a combustible substance until it unites freely with the oxygen of the atmosphere (or other gas), with the accompanying production of light and heat. Each combustible has a definite temperature at which the process of burning begins.

The knowledge of fire is world-wide, and few, if any, tribes have been found ignorant of its production and uses. The early methods of fire production made use of concussion or friction. The action of flint and steel was probably discovered in shaping stone into implements. Other concussion methods of fire production made use of pieces of quartz coated with native sulphur or iron pyrites, which were struck together. Early friction methods made use of two pieces of bamboo, broken pottery and bamboo, a stick used in rubbing a groove on a piece of wood, or a hand- or bow-drill rotated stick on a piece of wood. In every case the heat produced was used to ignite some material with a low ignition temperature. The action of the lens and concave mirror in concentrating the sun's rays to cause the ignition of inflammable materials was also known to the ancients.

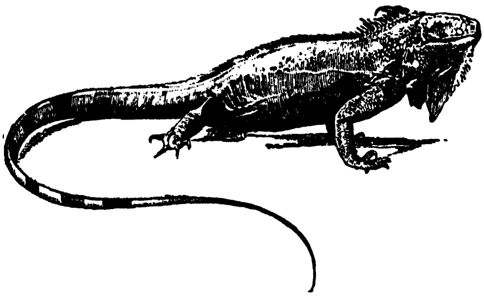
The word is also used to denote the firing of explosive mixtures in internal-combustion engines (q.v.).

Ignorance, in law, may be of law or fact. The former excuses no one, and is no defence in criminal proceedings; otherwise the administration of justice would be impossible. The latter may be a good defence if not due to negligence or omission of duty.

Ignoran′tines, a religious congregation of the Roman Catholic Church devoted to the gratuitous education of children. It was founded in 1679 at Rheims, and reorganized about 1683 by the Abbé de La Salle. The statutes of the order, approved by Benedict XIII in 1725, impose on its members vows of chastity, poverty, and obedience. In 1789 the order counted 1000 members, and possessed 121 houses. They were forced to quit France, but were recalled by Bonaparte in 1806. They are now to be met with in various countries. In France the law of 1882 banished them from the public schools.

Igualada (ē-gwȧ-lä′dȧ), a town in Spain, province of Barcelona, 36 miles W.N.W. of the town of Barcelona, on the Roya, with manufactures of cottons and woollens. Pop. 11,000.

Iguan′a, a genus of lizards, the type of the family Iguanidæ, a native of tropical America. It has an average length of about 4 feet. Its food consists almost entirely of fruits, fungi, and other vegetable substances. Its head is large, the mouth wide. Along the whole length of the back to the tip of the tail there is a crest of elevated, compressed, pointed scales; the lower part of the head and neck is furnished with a dew-lap or throat-pouch. The toes are furnished with sharp claws, which enable it to climb trees with ease, while a rapid serpentine movement of its tail propels it swiftly through the water. Its usual colour is dark olive-green. Its flesh is considered a delicacy, being tender and delicately-flavoured, resembling that of a chicken. The eggs, of which the female lays about two dozen, are also eaten, having an excellent flavour. They are about the size of those of a pigeon, are laid in the sand, and hatched by the heat of the sun.



Iguana (*Iguana tuberculata*)

Iguan'idæ, a family of American lizards of which the iguana is the type. They have the body rounded, sometimes laterally compressed and furnished with a ridge or serrated crest along the middle line of the back from snout to tip of tail, sometimes a throat-pouch or dew-lap present. See *Iguana*.

Iguan'odon, an extinct herbivorous colossal reptile found in the Wealden strata; so called from the resemblance of its teeth to those of the iguana. The pelvic bones were strikingly like those of birds. The integument does not seem to have possessed the spines or bony plates of allied species. The vertebræ of the back were flat at both ends, while those of the massive tail had concave surfaces. The teeth were large and broad, implanted in sockets, and transversely ridged. The just conclusions of Owen and of Mantell, the discoverer of the remains in England, were amplified by the study of a number of complete specimens of a still larger species near Mons, in Belgium, in 1878.

Il'chester, a town of England, in Somersetshire, anciently an important Roman station, and furnishing numerous Roman remains. Roger Bacon was born at Ilchester. Pop. 600.

Ildefon'so, San, a village of Spain, near which is La Granja, a royal palace, built in a mountainous country by Philip V, in imitation of Versailles, 6 miles north-east of Segovia, 40 miles north by west of Madrid. The palace contains a great number of valuable paintings and statues, and the gardens are magnificent.

Île-de-France (ēl-dė-frāṇs), a former province of France, having Paris as its capital, and now mostly comprised in the departments of Seine, Oise, and Seine-et-Oise.

Ilford, a town (urban district) of England, in Essex, forming part of the eastern suburbs of London, containing the lunatic asylum of the London County Council, and various industrial works. The place has a large and increasing working-class population. There is an interesting chapel of the hospital of St. Mary and St. Thomas, originally founded in the twelfth century. Pop. 78,205.

Il'fracombe, a market town of England, Devonshire, on the Bristol Channel, 41 miles N.W. of Exeter; very picturesquely situated. There is an inner and an outer harbour, the former admitting ships of 300 tons, and an active trade in coal, cattle, and agricultural produce with Welsh and Irish ports. Ilfracombe is much resorted to as a bathing-place and health resort. Pop. (1921), 11,779.

Ili, a river of Central Asia, partly in Chinese Turkestan but mostly in Russian. It is formed in Chinese Kuldja by two streams, the Tekes and Kunges, rising in the Tian-Shan Mountains, and flows westwards, falling into Lake Balkash by several mouths after a course of 800 or 900 miles, over half of which it is navigable.

Ilk'eston, a market town of Derbyshire, England, 9 miles E.N.E. of Derby, situated on a lofty hill. The church is a fine ancient building. Manufactures of hosiery and lace are carried on, and coal and ironstone are worked. Pop. (1921), 32,269.

Ilkley, a village of Yorkshire, England, 31 miles west of York, beautifully situated on the Wharfe, and much frequented on account of the hydropathic establishments. Near Ilkley is the fine old ruin of Bolton Priory. Pop. (1921), 9105.

Ille-et-Vilaine (ēl-e-vi-lān), a maritime department in the north-west of France, lying between the English Channel and the department of Loire-Inférieure. It is watered mainly by the rivers from which it derives its name—the Vilaine, and its tributary, the Ille. Little more than one-half of the surface is arable. The cereal crops consist chiefly of wheat, meslin, rye, and oats; other crops are buckwheat, hemp, tobacco, and flax. The minerals include iron, zinc, and lead. The principal manufactures are leather, sail-cloth, sacking, and coarse linens, and the coasting trade is active. Rennes is the capital; St. Malo the chief seaport. Area, 2697 sq. miles; pop. 558,574.

Illegit'imacy (Lat. *illegitimus*, not according to law), i.e. bastardy, is, under English law, the state of a child born (*a*) out of wedlock, or (*b*) during its subsistence if it is so proved that through absence or other cause the husband is not the father, or (*c*) within such a time after its dissolution that it is physically impossible for the husband to be the father. The obligation to maintain an illegitimate child rests on the mother, but if she can establish the paternity, the father may be ordered to contribute to its maintenance to an extent not exceeding 10*s.* per week until it attains the age of sixteen years or such earlier age as the justices may determine, or until the mother marries. The testimony of the mother as to the paternity must be supported by independent evidence in some material particular. Failure to implement her obligation so that the child becomes chargeable to the parish renders the mother liable to imprisonment, and the guardians may also proceed against the father. In Scotland the obligation is a joint and equal one, but the failure of either parent to implement it throws the whole responsibility on the other.

An illegitimate child, being in law *filius nullius* (the son of nobody), has no rights of inheritance in real or personal estate. He may, however, take a bequest under a will, and he has testamentary capacity. The only persons entitled to succeed to his estate on his intestacy are his widow and children. If, therefore, he dies unmarried and intestate, his estate escheats, but consideration is given by the Crown to the claims of other relatives. In Scotland (but not in England) an illegitimate child may be legitimated by the subsequent marriage of its parents, but an amendment of the English law in this respect is proposed by the Children of Unmarried Parents Bill, 1921. See *Legitimation*.—BIBLIOGRAPHY: W. Hooper, *The Law of Illegitimacy*; P. G. Kammerer, *The Unmarried Mother: a Study of 500 Cases*.

Illi′cium, a genus of Eastern Asiatic and North American evergreen shrubs, belonging to the nat. ord. Magnoliaceæ. The plants of this genus are called aniseed trees, from their fine aromatic scent. The fruit of *I. anisātum* (Chinese anise) is the star-anise of the shops (see *Anise*). *I. religiōsum* is a Japanese species, held sacred by the natives, who decorate the tombs of their dead with wreaths of it, and burn the fragrant bark as incense before their deities.

Illimani (il-yi-mä′nē), one of the loftiest peaks in the *Cordillera Real* of the Bolivian Andes, 22,500 feet high, and covered with glaciers. The highest peak was scaled in 1898 by Sir Martin Conway.

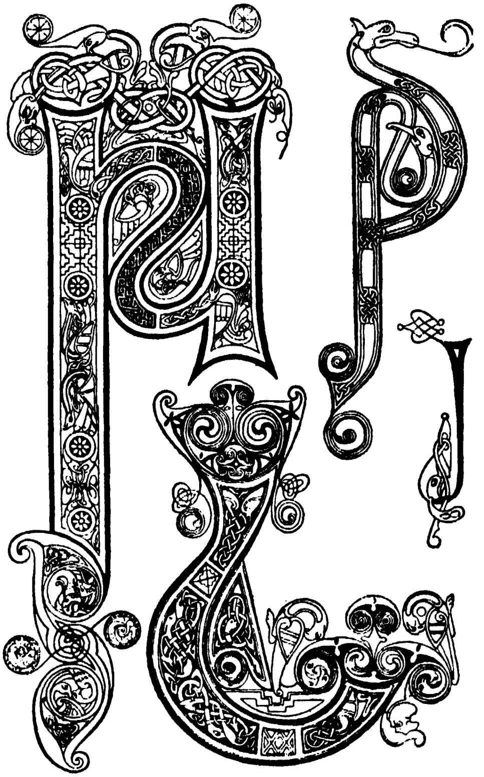
Il′linois (il′i-noi or -nois), one of the Western United States, bounded on the north by Wisconsin, east by Lake Michigan and Indiana, south-east by Kentucky, from which it is separated by the Ohio, and west by the Mississippi, separating it from Missouri and Iowa; greatest length, 370 miles; greatest breadth, 160 miles; area, 56,665 sq. miles. The surface is somewhat hilly near the Ohio, and undulating towards the west; and a range of bluffs runs for a considerable distance along the margin of the Mississippi; but with these exceptions the state is one continuous plain, with a gentle inclination towards the south-west. It has a greater proportion of arable land than any other state of the Union. The only thickly wooded part is the southernmost portion. The chief rivers are the Illinois (q.v.), which traverses the state, Rock, Kaskaskia, and Wabash. Indian corn and wheat are the chief objects of cultivation, but rye, oats, buckwheat, potatoes, turnips, cotton, hemp, flax, tobacco, castor-bean, &c., are also produced, and the cultivation of the vine is making considerable progress. Illinois is one of the great dairying states, cattle and pigs being extensively raised. Lead is found in vast quantities, and the ore (argentiferous galena) contains a considerable percentage of silver; the metal is found chiefly near the Wisconsin frontier, Galena being the centre of the mining district. Bituminous coal abounds, and is raised in very large quantities, and several valuable salt springs are found in the east and south. The rocks mostly are limestone, gypsum, and sandstone. The climate, although somewhat humid, is generally healthy. The Illinois and Michigan Canal connects Lake Michigan at Chicago with the Illinois at La Salle (distance 96 miles), and enables vessels of some size to pass from the Gulf of Mexico to the St. Lawrence. There is a well-organized school system. Illinois University, at Urbana, is a well-equipped institution, and there are besides twenty-eight other colleges and universities in the state. Springfield is the state capital, pop. 59,000, but Chicago, on Lake Michigan, is the principal commercial depot. Illinois was constituted a separate territory in 1809, and admitted as a state into the Union in 1818. Pop. (1920), 6,485,280.

Illinois, a river in the United States, formed by the union of the Kankakee and Des Plaines, in the north-east part of the state of Illinois. It flows thence south-west, and falls into the Mississippi about 20 miles above the mouth of the Missouri. It is 500 miles long, half of it being navigable. A canal connects the river with Chicago.

Illit′eracy (Lat. *illiteratus*, uneducated, without letters or learning), inability to read or write. The term illiterates is applied in the United States also to people who can read but not write. The greatest number of illiterates is to be found in Russia and in the East. In Germany, Sweden, and Switzerland there is less than 1 per cent, and in Holland a little over 1 per cent of illiterates. Belgium and France have about 10 and 5 per cent of illiterates respectively. The lowest percentage of illiterates is to be found in England, Wales, Scotland, Australia, and Germany.

Illumina'ti (' the enlightened '), a name given to the members of several societies, especially to those of a secret society founded in 1776 by Adam Weishaupt, professor of law at Ingolstadt, Bavaria, for mutual assistance in attaining a higher degree of morality and virtue. It spread over Roman Catholic Germany, and contained in its most flourishing condition 2000 members, among whom were men of distinguished talents and high rank. The constitution and organization were taken partly from the Jesuits and partly from the Freemasons. Dissensions, however, were introduced into the body, and in 1784 it was dissolved by the Bavarian Government.

Illumination is the process of ornamenting a written or printed text with colours and precious metals, but is often extended to include the decoration and illustration of manuscripts by drawings, with or without colour. The colour may be either transparent or mixed with body colour, and the metal applied in liquid form, or in sheets which are afterwards burnished. The usual foundation is vellum. The two elements of illustration and decoration in varying proportions appear in every illuminated manuscript, and their perfect balance and fusion marks all the great periods of the art. In European mediæval manuscripts the illustrative side is represented by the *miniature* (the technical term for the illustrations), and the decorative by elaborate initial letters and borders. The two combine in the *historiated initial,* where the letter encloses a miniature. The manuscripts most commonly illuminated in the Middle Ages were liturgical and devotional works, including *missals* (the mass book used by the celebrant at the altar), *breviaries* (containing the services for different hours), *psalters*, *graduals* (the choral part of the mass), *antiphoners* (the choral part of the services), and *books of hours* (intended for private devotion, and containing prayers, lessons, &c.). An elementary form of illumination appears in the coloured illustrations of Egyptian papyri; and a few classical texts of the fifth century A.D., illustrated with paintings similar in style to the Pompeian frescoes, point to the existence of an older tradition. But classic influence chiefly survives in Byzantine illumination of the ninth to the twelfth centuries, where it combines with Eastern influences to produce a hieratic, stylized art, mainly illustrative, richly treated in gold and colour. Meanwhile, a great school of Celtic illumination developed in Ireland, marked by very conventional treatment of the figure, and an ingenious and varied use of abstract and geometrical ornament, without the use of gold. A remarkable example is the *Book of Kells,* at Trinity College, Dublin. The influence of this school passed to England, Italy, and Germany, and in the last combined with Byzantine and debased classical elements to produce the Carolingian school, which centred round the court of Charlemagne in the ninth century. At this period, also, there was a notable development of outline drawing (represented in the famous Utrecht psalter), which in England unites with the use of gold and colour from Carolingian and Celtic sources to produce the characteristically rich and delicate style of the tenth- and eleventh-century Winchester school. The same influences operate in different degrees in France, and by the thirteenth century illumination in the two countries had settled down into the lines whereon it was to develop, and may be now described as characteristically Gothic. The handling becomes minute and delicate; historiated initials are the rule; elaborate borders springing from the pendant to the initial enclose the page; and gold is applied in leaf form and burnished. A notable



Initial Letters from the *Book of Kells* and other old Irish Illuminated Manuscript Volumes example is the French *Psalter of St. Louis* (Bibliothèque Nationale). In Flanders development is similar but slower; while in Germany, after a brief period of activity connected with the tenth-century Ottonian Renaissance, illumination degenerates and never revives. In Italy a burst of activity under Celtic influence centres in the Benedictine monastery of Monte Cassino, but is followed by a period in which Byzantine influence predominates. The fourteenth century sees English illumination at its highest point, and distinguished from French by greater naturalism in its borders, and a love for the droll and grotesque (possibly imported from Flanders), both seen in the *Queen Mary Psalter* in the Royal Collection; but in the fifteenth century comes a rapid and permanent decline. In France, where ornament is more conventionalized and the use of diapered backgrounds a special feature, the triumphs of the fourteenth century include the *Belleville Breviary* (Bibliothèque Nationale), and the work done for the library of Jean, duc de Berry (1345–1416), by André Beauneveu and Jacquemart de Hesdin. These are followed early in the fifteenth century by the exquisite and magnificent *Très riches heures* (now at Chantilly), executed for the same patron by Pol de Limbourg and his brothers, one of the most remarkable manuscripts ever produced, which marks a culminating point. The great skill of Jean Foucquet and his followers (notably Jean Bourdichon) later in the century resulted in paintings on a small scale rather than illumination proper, and represents a decline. In Flanders and Italy, however, the art survived longer. Flemish illumination developed *pari passu* with Flemish painting, and is marked by soft, harmonious colour and increasing naturalism, manifested in elaborate landscape background, sculpturesque figures, the use of perspective, and in the border treatment. The *Grimani Breviary* (S. Marks, Venice) is a well-known example of the style. In Italy, under the influence of easel painting, the tendency was to produce full-page illustrations (notably to the large choir books) rather than decoration, though a characteristic border of rods and curling foliage was evolved, seen in the fourteenth-century work of Niccolo da Bologna. In the fifteenth century Renaissance influence appears in the treatment of the figures and in the decorative elements of the borders (putti, masks, and garlands), and at the end of the century a great group of manuscripts appears well represented by the Sforza *Book of Hours* (British Museum). Printing virtually killed illumination. In the East, however, especially in India and Persia, a flourishing school existed until the early nineteenth century.—BIBLIOGRAPHY: J. A. Herbert, *Illuminated Manuscripts*; A. Michel, *Histoire de l'art* (embodying sections on the miniature); Count P. Durrieu, *Les Très riches heures de Jean, duc de Berry*, and other writings; Sir G. F. Warner (editor), *Reproductions of Illuminated MSS. in the British Museum.*

Illustration is, in the widest sense, the pictorial expression of a fact or idea previously expressed in words; and as such has been the basis of all save purely abstract art from the earliest times. More usually the term describes pictorial art associated with written or printed matter to express the same facts or ideas. Apart from the illuminated manuscripts of the Middle Ages (see *Illumination*), it first appears with the invention of printing, its use becoming possible through the development of engraving on metal and wood. Important early examples of book illustration are those by Botticelli (engraved by Landrino) to Dante's *Divina Comedia*, and by Holbein to Erasmus's *Praise of Folly*. The style of illustration at any period mainly reflects that of contemporary painting and engraving. In fact it is not until modern times that artists almost solely concerned with illustration appear. Thus, in fifteenth- and sixteenth-century Germany illustration centres round the work of Dürer and his followers; and in seventeenth-century Italy reflects the influence of the Bolognese and Roman eclectic painters. In France, during the eighteenth century, a delicate and delightful group of engravers, such as Oudry, Gravelot, and Moreau le Jeune, based their illustrations to such works as La Fontaine's *Fables* and Molière's plays on the eighteenth-century painters from Watteau to Fragonard. In England, seventeenth-century illustration mirrors the supremacy of Dutch and Flemish painting, notably in the engraved portraits and frontispieces of Faithorne. Hogarth, who himself illustrated Butler's *Hudibras* and other books, marks the rise of a school of realism and caricature, of whom a great master is Thomas Rowlandson, followed in the nineteenth century by George Cruikshank, well known by his illustrations to Dickens. Side by side with these is a graceful, rather exotic school founded on the work of Reynolds, and typified by Bartolozzi. Both the technique of his woodcuts and the fact that illustration was the main work of his life make Thomas Bewick a leading figure at the end of the eighteenth and the beginning of the nineteenth century. Among his contemporaries, Stothard and Flaxman represent the classicism of the age, and William Blake a mystic, individual art of great interest and importance. But the chief note of the early nineteenth century in England is the quantity of landscape illustration produced under the influence of Turner, such as his illustrations to

Rogers' *Italy*. With the rise of the illustrated periodical a new era begins. Illustration ceases to be mainly reproductive; artists whose sole work is illustration increase in number; and illustrators are encouraged to draw direct upon the wood, the material chiefly employed. An earlier phase of this movement is represented by Sir John Tenniel, Sir John Gilbert, and Birket Foster; a later and more important development by the Pre-Raphaelites, Madox Brown, Millais, and Rossetti, whose work is well represented in contemporary periodicals. A more romantic school is typified by Frederick Sandys and A. B. Houghton; a more realistic by the important group associated with *Punch*—John Leech, George du Maurier, and Charles Keene. The course of illustration in France and Germany was parallel. The Romantics, with Delacroix at their head, produced much work in *L'Artiste* and elsewhere; Gavarni and Daumier a matchless series of caricatures, mainly reproduced by lithography. Other interesting figures are Gustave Doré (the illustrator of Dante and Rabelais), and the modern satirists Forain and Steinlen. In Germany the realistic work of Adolf Menzel had great influence, while at Munich a decorative symbolist group of illustrators grew up, represented by Klinger and Stück.

Modern illustration has been much affected by technical developments, all based upon photography. Engraving upon metal has practically fallen into disuse, though etching is still used for a few elaborately-produced books. Wood engraving now mainly serves to decorate finely-printed books, such as those of the Kelmscott and other presses. Notable work of this kind has been done by Charles Shannon, Ricketts, and Sturge Moore. This tendency towards decorative illustration, partly inspired by Japanese art, is also seen in the work of Aubrey Beardsley, and in the elaborate work of Arthur Rackham and Edmund Dulac. The facility and accuracy of modern methods of reproduction, however, have rather tended to diminish the proportion of artists whose sole work is illustration. Among the more important of these methods are *line* and *half-tone* process, in which the printing surface stands above the surrounding ground; photogravure, in which the ink lies in a series of tiny pits and grooves; and *collotype*, where the printing surface is a sheet of gelatine, prepared to absorb or give up ink in proportion to the depth of various tones in the picture. Another important modern development is *colour printing*, now generally performed by the three-colour process (based upon half-tone process) or by collotype.—Bibliography: W. J. Linton, *Masters of Wood Engraving*; J. Pennell, *Pen Drawing and Draughtsmen*; *Modern Illustration*; T. G. Hill, *The Essentials of Illustration*; A. M. Hind, *Short History of Engraving and Etching*; E. J. Sullivan, *Art of Illustration*.

Illyr'ia, or **Illyr'icum,** a name formerly rather loosely applied to a large tract of country on the east side of the Adriatic, the ancient Illyrians being the ancestors of the modern Albanians. Piracy was carried on by the Illyrians, whose kings were therefore embroiled in quarrels with the Romans, which ended in their subjugation in 228 B.C. They sought from time to time to shake off their chains; but being always beaten, the country at last became a Roman province. The name of Illyrian Provinces was given, by a decree of Napoleon in 1809, to Carniola, Dalmatia, and other countries, then part of the French Empire. After the fall of Napoleon the Illyrian Provinces were restored to Austria, and designated as the Kingdom of Illyria, a title which the country bore till 1849, when it was divided into the provinces of Carinthia, Carniola, and the Coast-lands.

I'lmen, a lake in Russia, government of Novgorod, near its western borders; length, about 33 miles; breadth, 28 miles. It receives numerous streams, and discharges itself by the Volkhov into Lake Ladoga. It abounds in fish.

Il'menau, a town of Central Germany, in Saxe-Weimar-Eisenach, on the River Ilm. It has a grand-ducal castle, manufactures of porcelain and terra-cotta ware, and a hydropathic establishment. Pop. 12,000.

Iloilo (ē-lō-ē'lō), a seaport on the south coast of Panay, one of the Philippines, the second port of the group, exporting much sugar. Pop. (including suburbs), 48,000.

Il'orin, or **Illorin,** a town in West Africa, Northern Nigeria, about 150 miles N.E. of the Bight of Benin, a great centre of trade. Pop. 70,000, mostly Mahommedans.

Image, in optics, a transient picture produced by means of light. An image of an object may be formed by reflection, by refraction, or by

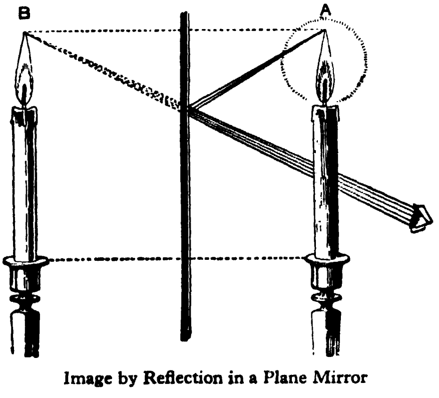


Image by Reflection in a Plane Mirror

transmission of light through a small aperture. When light proceeding from a point A is reflected by a plane mirror, the reflected rays all seem to come from a certain point B behind the mirror. Similarly, the mirror produces an image of an extended object, the light which comes from the object and is reflected at the mirror seeming to come from a counterpart, or image, of the object behind the mirror. In this example the reflected light by which the image is seen does not actually pass through the image, since the light remains always on one side of the mirror. The image is therefore said to be *virtual.* When the light actually goes through the image, the image is said to be *real*; in this case it may be seen in the air, by means of scattered light, or it may be caught on a screen. See *Light*; *Lens*; *Optics*; *Microscope*; *Telescope.*

Imaginary Quantity, in mathematics, an expression involving the square root of a negative number. By the laws of algebra, the square of either a positive or a negative number is positive. It follows that no positive or negative number can be the square root of a negative number. If, then, such an equation as $x^2 = -4$ comes up for solution, we are entitled to say that it has no solution, since no positive or negative number exists the square of which is -4. From this point of view, a quadratic equation may have a solution, or it may not. There is another point of view, however, to the adoption of which the wonderful development of mathematical analysis in modern times is chiefly due. The realm of *real* number, which originally contained positive, or signless, integers only, was afterwards extended by the inclusion of fractional and negative numbers. Similarly, we now introduce a new class of numbers, called *imaginary numbers,* and write for the solution of the equation $x^2 = -4$, $x = \pm \sqrt{-4}$. These new numbers are to be combined with one another, and with real numbers, according to the laws of algebra. Since $-4 = 4 \times -1$, we may write $2\sqrt{-1}$ instead of $\sqrt{-4}$; in fact, we may verify at once that $2\sqrt{-1} \times 2\sqrt{-1} = 2 \times 2 \times \sqrt{-1} \times \sqrt{-1} = 4 \times -1 = -4$. The letter i is generally used for $\sqrt{-1}$; it is often called the imaginary unit. Any imaginary number can be expressed in the form $a + bi$, where a and b are real numbers. The number $a + bi$ is often called a *complex* number, the number bi being called a *pure imaginary*; so that a complex number is the sum of a real part and a pure imaginary part. Any of the operations of algebra, when performed on a complex number, lead to another complex number. The realm of number, in which the laws of ordinary algebra are fulfilled, is therefore now complete, in a sense in which the realm of real number by itself was not. See *Trigonometry*; *Function*; *Theory of Functions of a Complex Variable.*

Imagination (Lat. *imaginari,* to picture to oneself), literally that faculty of the mind by which we can form mental *images* of things. Besides the power of preserving and recalling such conceptions, the imagination has the power to combine different conceptions, and thus create new images or mental pictures. It is this faculty which is more strictly termed imagination. In the creation of new images, or more properly in the combining of images which have previously been derived from objects of perception, the imagination operates according to the laws of the association of ideas. Its operations are nevertheless not wholly independent of the will, for by directing the attention to some leading thought, the will can determine the limits within which the laws of association are to act. Such regulated action alone can give rise to truly artistic creations. Imagination is a complex power, to be paralleled with reasoning and with will, not with sensation or feeling. It has been rightly defined as the primitive form of reasoning, 'thinking in pictures'. But whilst reasoning works more in the abstract, with verbal images, and endeavours to determine what *is* or *must be,* imagination works with object-images, and is concerned with what *might have been.* The driving force of imagination is always emotion, and it is this emotional tone which distinguishes imagination from reasoning. See *Psychology.*—BIBLIOGRAPHY: T. Ribot, *Essai sur l'imagination créatrice*; William James, *Principles of Psychology.*

Imam (i-mäm; Ar., leader or guide, from *amma,* to lead), a title given to the Mahommedan princes of the early period, to the four successors of Mahomet, and to the twelve great leaders of the Shiites. In modern usage the name is applied to functionaries and ministers, chosen by the people and representing them, and officiating in the mosques. In Turkey they call the people to prayer from the minarets, perform circumcision, and the rites of marriage and burial. In ecclesiastical affairs they are independent, and are not subject to the mufti, though he is the supreme priest. They may quit their office and re-enter the lay order. The Sultan, as chief of all ecclesiastical affairs, has the title of *imam.*

Imaus (i-mā'us), a name applied by the ancients sometimes to the Hindu Kush and the western part of the Himalayan range, and sometimes in a vague way to a range in Central Asia (supposed to be the Altaian Mountains), which they believed to divide the vast region to which they gave the name of Scythia into two parts.

Imbecil'ity (Lat. *imbecillus,* weak), weakness of mind which has been acquired, in contradistinction to idiocy, which is a failure in the development of intelligence. Imbeciles sometimes display a considerable amount of intelligence in certain directions, and are often very cunning. They may be interesting, amusing, and even useful members of a community. In England there are no special legal provisions in regard to imbeciles; but this is not the case in Scotland, where it is recognized, for instance, that a person of weak mind may have sufficient understanding to execute one class of deeds without being capable of executing another class. As a general rule the court is ready to support the obligation of any contract that a person of weak mind has entered into, unless it is of such a nature that a person of sound mind would not have agreed to it, or unless there is suspicion of fraud. An imbecile person may be summoned as a witness, but the degree of credibility attaching to his evidence naturally depends very much on the amount of intelligence he displays, and on the nature of the circumstances regarding which his evidence is offered.—Cf. H. H. Goddard, *Feeble-mindedness: its Causes and Consequences.*

Imbro, or **Imbros**, an island in European Turkey (restored at Lausanne in 1923), west of the entrance to the Dardanelles, 18 miles long and 8 miles broad. It is mountainous, well wooded, and intersected with richly-fertile valleys, producing wine, honey, oil, cotton, and lead. It has several villages, and the chief town is Castro. Imbro was used as a military base by the British during the European War. Pop. 9000, mostly Greeks.

Immersion, in astronomy, the disappearance of a heavenly body when another passes in front of it, as in the occultation of a star or planet by the moon, or a satellite by its primary. The reappearance at the end of the occultation is called *emersion.*

Immigration. The distinction between immigration and colonization has reference mainly to the condition of the country entered. A thinly-populated country will invite immigrants as colonists; as its population grows and settled communities cover it, it will admit immigrants only under more or less stringent conditions. The importance to humanity of the opening up of new territory by colonization is obvious. Colonists have been actively recruited by the administrations of developing countries, and legislation in their favour introduced, such as the homestead laws of North America and the Russian Siberian Law (1904); or regulations framed as in Canada, Bolivia, Chile, &c., to attract suitable elements. Free or assisted passages, premiums to agents or the immigrant colonists themselves, are devices to tempt immigrants which have been adopted by Siberia, New South Wales, Natal, and various South American states. On the other hand, very stringent legislation exists against undesired immigrants. Thus Congress passed a law forbidding Chinese immigration into the United States for ten years from 1882. The law was extended for further periods in 1892, 1905, and 1917. Chinese immigration is prohibited entirely except for officials, teachers, students, merchants, and travellers for pleasure, with their families and servants. Chinese immigration into Australia was restricted by the various states before the founding of the Commonwealth, and the Commonwealth Immigration Restriction Act of 1901 admits only those Chinese, Japanese, Kanaks, and Malays who can write fifty words from dictation in a European language. New Zealand imposes a poll tax of £100. Canada imposed in 1903 a poll tax of 500 dollars on immigrant Chinese; British Columbia has limited Chinese immigration since 1878. Japanese immigration is equally opposed in North America and in Australia and New Zealand, the Japanese being regarded as ruthless business competitors and as much more formidable politically than the Chinese. In South Africa, after the Boer War, many thousands of Chinese were imported for work in the Transvaal mines, but on the granting of autonomy to the Transvaal Government it at once resolved to repatriate the immigrants and to forbid the renewal of their contracts.

Much the most important field for immigration has hitherto been the United States, the 'melting-pot' of the European races. Immigration into the United States up to 1880 came mainly from Scotland, Ireland, Germany, and Scandinavia; since then the main stream has come from Italy, Austria, Poland, and Russia, these sources accounting for more than half the total in the early years of this century. The immigration was not entirely spontaneous; it was largely due to recruiting by agents of the big shipping companies. Stringent laws barring out undesirable immigrants were passed in 1882 and 1893 (re-enacted in 1917 with a literacy test added), and the steamship companies were made liable for the repatriation of immigrants turned back. A particularly objectionable form of immigration, under contract to perform labour at rates below those secured by trade union organization, was attacked by the Labour Contract Law of 1885, which forbade immigration by labourers under contract. The immigration into the United States averaged over 1,000,000 souls a year in the decade preceding the European War, but fell below 300,000 in 1915–6, and amounted in 1917–8 to no more than 110,618, and in 1918–9 to 141,132. A *quota* system of immigration was introduced by the United States after the European War, whereby each nationality is allowed only a definite quota of immigrants per month.

Immigration is not an unmixed blessing even to the newer countries. The immigrants without special skill cannot be assimilated as easily as when there was virgin land within easy reach to bring into cultivation, and when machinery was in less general use. Immigrants tend, moreover, to come to rest in the large cities instead of spreading over the country, and so to increase the already excessive city population and accentuate urban unemployment.

Immortality means the survival of the human soul or personality after death. In some more or less naive form, this belief is current among practically all primitive peoples, and comparative religion investigates the causes of such a conception, e.g. perhaps in the phenomena of dreams, where the dreamer sees the figures of those who have already died. But whatever originally suggested or shaped the belief in immortality, it has been deepened and moralized as civilization progressed. Both philosophy and religion in modern times have set themselves to examine afresh the evidence for the belief, and to ascertain how far it is reasonable. In point of fact, it goes back ultimately to Greek philosophy and to the later Judaism; for Western nations, within the Christian tradition, these are the fundamental sources of faith in immortality. The speculations of Platonism and the religious convictions which arose in Christianity upon the soil of the later Judaism—these, rather than any influence of primitive customs or traditions, determine the modern conception of immortality.

In Platonism it was the immortality of the soul as participating, by means of its higher mental and moral activities, in the eternal and changeless ideas. To Plato belief in immortality was of supreme practical importance, but he adduces a metaphysical proof for it. The soul is the immortal part and principle in mortal human nature, a unity which rules and does not depend for its existence upon the material body. As an idealist, Plato believes that the human consciousness is too precious to be a mere product of material conditions; he stands aloof from the current beliefs about immortality which were being already spread in the popular mystery-cults, but in his own way he inclines to trust 'the great hope' that death does not end the activity of the pure soul.

The development of faith in immortality which marked the Jewish religion is very different. It came late in the history of the religion. The naive, almost matter-of-fact, belief in the next world, which characterized Egypt left the early Hebrews untouched. Egyptian religion was based upon faith in immortality, which took a semi-physical form. The outlook varied indeed. Heterogeneous views of the next world prevailed; (*a*) the soul was kept in the tomb, to be revived ultimately on earth; or (*b*) it went to the western land of light and rest; or (*c*) it joined the Kingdom of Osiris. But the Egyptians viewed death as an interruption to existence, never as annihilation, and their practice of mummification went back to the basic faith that the spirit required the body to be kept as complete and comfortable as possible. The future world was a continuation of the present on higher lines, and the fortunes of the soul there depended on its conduct in the present, though no doubt to some extent on magical rites. All this was alien to the Hebrew religion, which for centuries throve without any definite faith in immortality. Beyond death, at first, the Hebrews saw a mere shadowy, attenuated existence in the underworld; the real future life for a man lay in his family and descendants. Eventually the deepening sense of value in the individual personality led to an instinctive hope of immortality; also, the apocalyptic craving for a divine assize after death to reward the martyrs and faithful, and to condemn the wicked. The faith in immortality ratified the faith in the moral order and the individual's consciousness of the implicates of personal communion with God.

The Christian development originally proceeded along the Jewish lines, eschewing a disembodied immortality, and postulating a resurrection which involved the entire personality—the soul receiving at the final resurrection a 'body' or organism adequate to its full powers. Often this was crudely expressed, as though the dead body were to be literally raised. And at the opposite extreme, the influence of Platonism sometimes fostered an idealistic conception of immortality which simply regarded the soul as immortal. In philosophical discussion, the latter idea is connected with the assumption that the soul as such is immortal, since it either is in itself an indestructible substance or is endowed with properties of desire and growth which lead to an infinite development. The main stress today, however, both in philosophical and religious circles, is upon the ethical reasonableness of the belief in immortality, viz. that the mental and moral development of the human personality here starts a process for which the term and limits of life between the cradle and the grave are insufficient, and that goodness, love, truth, and beauty in a human life carry their implicit promise of full realization after death. "I have no doubt that the faith in immortality owes its large extension among men, in no slight degree, to the secret feeling that in the nature of man there is more contained than the measure of the present life requires and satisfies" (Martineau, *A Study of Religion*, ii, p. 359). For believers in the Christian revelation, this is guaranteed by the resurrection of Jesus from the dead, and the consequent realization of a fellowship in which the personality of the believer enters upon an eternal relationship to the divine life. The immortality here promised, however, is of the personality; the soul at the resurrection is to be invested with a ' body '. Most Christian theologians hesitate to accept theories of an innate immortality of the soul, and prefer to ground immortality on the personal experience of the believer, on the ethical and spiritual completion of his relation by faith to the living God, the supreme reality being not death but God.

Philosophical and scientific investigation may support this belief by offering evidence that, while the soul is dependent upon its present physical body, it is not so dependent as to perish necessarily with that body. Whether the further step can be taken, of proving by means of psychical research that communication between the spirits of the departed and the living involves the survival of the personality after death, is one of the debated problems of the age. Much depends, in this connection, upon the extent to which telepathy can be safely employed as a source of inferences regarding life after death.

Two particular phases of the argument regarding immortality may be mentioned in conclusion. (*a*) Corporate immortality, i.e. the immortality of the race as a whole, has been generally set aside, as inadequate. To have any satisfactory meaning, immortality must be personal. (*b*) Conditional immortality, on the other hand, has never ceased to attract a certain number of thinkers, i.e. the theory that immortality, instead of being inherent, is the reward of God for human faith, and that unworthy souls, instead of being condemned to eternal punishment, are extinguished.—BIBLIOGRAPHY: J. Fiske, *Man's Destiny*; S. D. F. Salmond, *The Christian Doctrine of Immortality*; William James, *Human Immortality*; F. W. H. Myers, *Human Personality and its Survival of Bodily Death*; S. H. Mellone, *The Immortal Hope*; Sir J. G. Frazer, *The Belief in Immortality*.

Immu'nity, the power inherent in any living organism, or acquired by it, of resisting the invasion of micro-organisms such as are liable to cause diseases. The tissues of every animal exhibit varying degrees of susceptibility to bacterial and other kinds of infection. Organisms which give rise to virulent diseases in some animals may be totally destroyed or fail to cause an infection when inoculated into other animals or even into an animal of the same species. The degree of immunity or susceptibility of any animal to a given microbe may be influenced by external and internal conditions. The natural immunity of the healthy human body may be diminished by any circumstances that lower its vitality, its power of resistance. Thus wet and cold, starvation and malnutrition, age, loss of blood, certain poisons such as alcohol, vitiated atmosphere, and debilitating affections like diabetes and Bright's disease have a marked effect upon the natural immunity. Local injury or anything that lowers the vitality of any region of the body facilitates infection.

But immunity may be acquired, as, for example, by a previous attack of the disease, which may have been acquired naturally or by artificial inoculation. Many of the exanthemata confer this active immunity, and free the individual from the risk of acquiring the disease again. By inoculating persons with a mild form of a disease, as in vaccination against the risk of smallpox, they are protected against infection by the more virulent and dangerous form. Within recent years a method of immunization against certain diseases (plague, typhoid fever, &c.) has been devised whereby dead cultures of the organism of the disease are injected under the skin. The subject acquires immunity in these cases by the active reaction of its own tissues against the toxic materials injected into it. But an analogous result can be produced in a passive way without submitting the patient's organism to the reaction directly against the virus. Thus one animal may be immunized by the repeated injection into it of dead bacteria, and its serum is then introduced into the animal or human being to be protected against the risk of the disease in question. This method is employed in making human beings immune against tetanus, the antitoxic serum being obtained from horses. —BIBLIOGRAPHY: J. Citron, *Immunity*; E. T. Fraser, *A Manual of Immunity*.

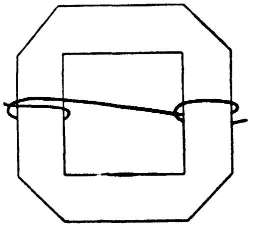
I'mola, a town of Italy, in the province of Bologna, on an island in the Santerno, 25 miles west by south of Ravenna. Besides its walls flanked by towers, it possesses an old castle situated on a commanding height, a cathedral and other churches. Pop. 34,000.

Impa'tiens, a genus of herbs, ord. Balsaminaceæ. One species, *I. Noli-tangere*, indigenous in England, is called *noli-me-tangere*, or touch-me-not. *I. balsamina* is much grown for the beauty of its flowers, and is well known as a highly ornamental annual by the name of garden balsam. The species are numerous, and inhabit chiefly the East Indies, although some extend into Europe, Siberia, and North America. The name refers to the elasticity of the valves of the seed-pod, which discharge the seeds explosively when ripe or when touched.

Impeachment (Lat. *impedicare*, to fetter the feet), an accusation and prosecution for a crime or misdemeanour, in which the House of Commons are the prosecutors, and the House of Lords the judges. The necessity of some tribunal distinct from the ordinary courts, for the trial of certain offences, or for any high misdemeanour in certain officers, is apparent, since the judges of the highest courts cannot in all cases safely be entrusted with the trial of one another. Impeachment is, however, seldom used, the first instance being that of Lord Latimer in 1376, and the last that of Lord Melville in 1806. One of the most famous impeachments in English history is that of Warren Hastings, which ended with his acquittal in 1795. After sentence (which is pronounced only if the Commons demand it) the Crown may pardon the offender. The question of guilty or not guilty is decided by a majority of votes.—In the United States the procedure is similar to that of England, the House of Representatives being the accusers, and the votes of two-thirds of the Senate being necessary for a conviction.

Impedance, in electricity, the ratio of the root-mean-square voltage to the root-mean-square current in a conductor or apparatus carrying alternating current. The impedance of a circuit depends on three factors, viz. its *resistance*, its *inductance*, and its *capacity*. If resistance $= R$ ohms; inductance, or coefficient of self-induction $= L$ henrys; capacity $= C$ farads; and if the number of cycles per second is k, then the formula for the *impedance*, in ohms, is $\sqrt{\{(2\pi kL - 1/\overline{2\pi kC})^2 + R^2\}}$; and $2\pi kL - 1/(2\pi kC)$ is called the *reactance*, which is also measured in ohms. In a circuit which includes no capacity, C is infinite, and the term in C disappears. In this case, impedance $= \sqrt{(4\pi^2 k^2 L^2 + R^2)}$, reactance $= 2\pi kL$. See *Impedance Coils*; *Inductance*.

Impedance Coils, or **Choking Coils**, are electrical appliances used on alternating-current circuits to obstruct the flow of current. In ordinary direct-current work at constant pressure, the current in a circuit can be reduced by increasing the 'resistance' of the circuit. Electrical energy is converted into heat in the resistance. In alternating current, on the other hand, the obstruction which the circuit offers to the flow of current is made up not only of 'resistance' but of 'reactance', the measure of the total obstruction being named the 'impedance' of the circuit. The required obstruction can therefore be got by means of reactance instead of by resistance, and since the reactance voltage is 90° out of phase with the current, it consumes no power. (See *Inductance.*) A reactance coil is constructed as follows: A laminated iron core, in the form of a ring, has a coil of wire wound round it thus: The coil is continuous, and is connected in series in the circuit. The alternating magnetic field set up in the iron ring brings into play, by induction, the pressure of reactance. The apparatus is usually placed under oil in a fluted tank, the fluting being provided to give a large cooling surface.—BIBLIOGRAPHY: C. P. Steinmetz, *Alternating Currents*; C. G. Lamb, *Alternating Currents.*



Impenetrabil'ity, in physics, that property of matter which prevents two bodies from occupying the same space at the same time; or that property of matter by which it excludes all other matter from the space it occupies. The fact that, when two liquids are mixed, there is often a contraction of the total volume is explained by the closer packing of the molecules of the two liquids.

Impera'tor, among the ancient Romans, a term originally applied to a military commander, one who held the *imperium*, or military power. In later times no one received this title who had not defeated a hostile force of at least 10,000 men. After the overthrow of the Republic *imperator* became the highest title of the supreme ruler, and acquired the signification which we attach to the word *emperor*. It was still given, however, to triumphant generals, and in this case has its old signification. The emperors appear to have used it because they were considered as superior to all the generals. See *Emperor*.

Imperial Federation, a movement, started towards the end of the nineteenth century, in favour of the federation and consolidation of the British Empire as a whole, by the bringing of its different parts into closer commercial and political relations. The object was promoted by several leagues or unions, at home and in the colonies; such as the Imperial Federation League, founded by Lord Rosebery in 1884, the Imperial Federation Defence (1893), the United Empire Trade League, the British Empire League, &c. Joseph Chamberlain's advocacy of a change of our fiscal system was based on the desire for a closer union of the colonies and the mother country. In the twentieth century frequent meetings and conferences of the Premiers of the dominions have been held periodically for the purpose of furthering such a closer union.

Imperial Institute, an institution founded in London in 1887 (partly as a jubilee memorial), and housed in a fine building at West Kensington, its object being to further the commercial, industrial, and other interests of the colonies, India, and the United Kingdom. Since 1899 a large portion of the building has been occupied by London University, as remodelled. The management of the Imperial Institute was transferred to the Board of Trade in 1903, and in 1916 to the Colonial Office.

Imperialism (Lat. *imperium*, military authority, empire) is a term applied to the policy of expansion and dominion of a state or of an empire beyond the limits of self-coherent nationality.

In ancient times we find historical examples of imperialism in Assyria, Persia, Egypt, and, above all, in Rome. This policy of imperialism was again revived in the Middle Ages by Charlemagne, and in the sixteenth century by Charles V. Napoleon, who extended his dominion over non-French territories, was a striking example of imperialistic policy in more recent times. After the overthrow of Napoleon—and especially after the Congress of Vienna—a wave of nationalism, or the establishment of political union on the basis of nationality, swept over Europe, and the idea of nationality, or the independence of ethnically homogeneous elements, found currency everywhere. This nationalist movement was witnessed throughout Europe from 1815 to the present day. It resulted in the breaking away of Greece and of the Balkan States from Ottoman rule, in the liberation of Italy, and in a national revival in Ireland, Poland, Finland, Bohemia, and Hungary. A reaction, however, set in after the Franco-Prussian War of 1870, and once more the imperialistic movement manifested itself in European politics. Modern imperialism, however, differs from ancient imperialism, as it endeavours to reconcile national independence with imperialistic policy. It conceives not one but many civilized world-states, each ruling its dependencies and protectorates, and those nations which are considered to be incapable of governing themselves. It is the old imperalism in a new disguise, or an imperialism which is anxious not to contradict too openly the modern ideas of democracy, and particularly the favourite idea of the twentieth century—nationalism. This modern imperialism may be termed internationalized nationalism. The result of this imperialism has been a competitive struggle between European Powers and a scramble for Asia and Africa. France, Great Britain, Belgium, Portugal, Spain, Italy, Germany, Russia, and Japan have been, and still are, engaged in this struggle. For the last thirty years it has often created discord among the Great Powers, and in more than one instance has led to wars. During this period not only the European Powers but also the United States have annexed or extended their political sway over vast areas in Asia, Africa, and the American continent.

Thus Japan annexed Korea; Italy took Tripoli and Cyrenaica; France established a protectorate over Morocco, and Great Britain over Egypt. Russia extended her sphere of influence in Persia and Manchuria, and Germany's imperialistic tendencies resulted in the European War.

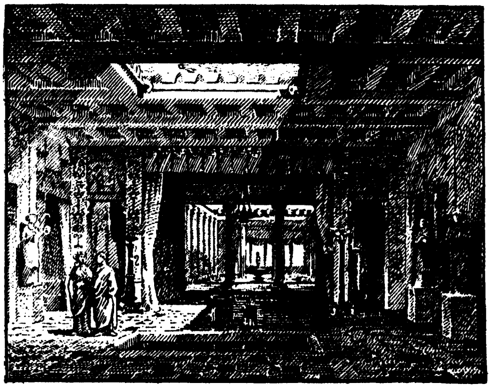
In Great Britain the term imperialism is applied, in a narrower sense, to the movement which advocates a closer relationship between the mother country and the colonies, and also the expansion and spread of British influence throughout the world. The Imperialists are in favour of strong armaments and of an increasing naval power, whilst their opponents, frequently referred to as ' Little Englanders ', adhere to the doctrines of Cobden and to the principle of *laissez-faire*. They maintain that imperialism, in any shape or form, is not advocated in the interest of the nation as a whole, but only in that of certain classes. This imperialistic movement is termed Imperial Federation, and in 1884 an Imperial Federation League was established, and replaced in 1893 by the Imperial Federation Committee. Among British statesmen prominent Imperialists were Lord Beaconsfield, Lord Rosebery, and Joseph Chamberlain.—BIBLIOGRAPHY: J. A. Hobson, *Imperialism: a Study*; Earl of Cromer, *Ancient and Modern Imperialism.*

Imperial Service Order, an order instituted by King Edward VII in 1902, and extended in 1909, as a reward for members of the Civil Service, home or colonial, who have served not less than twenty-five years (reduced to sixteen years in the case of unhealthy regions). The order consists of not more than 700 Companions, of whom 250 are members of the home Civil Service, 250 of the Colonial Civil Service, and 200 of the Indian Civil Service. The sovereign and the Prince of Wales are at the head of the order. Companions are appointed on the recommendation of a Secretary of State, and are selected from those who have served in an administrative or clerical capacity. A star in silver and gold, with the inscription " for faithful service ", is the special decoration of the order. A special medal is conferred for long service on civil servants of a lower grade who are not eligible as Companions. The initials I.S.O. mark the status of a Companion.

Impeti'go is an acute inflammation of the skin characterized by the formation of flat vesicles which become pustular. The disease is very common, and children are more often affected than adults. It is one of the commonest diseases seen in the out-patient department of any large hospital. Once infected, a person is very liable to infect other parts of the body by scratching, rubbing, &c., and where people are living in close contact the disease is rapidly spread from one to others. In men infection often occurs in the barber's shop. It very frequently arises as a secondary condition to other skin diseases where there is severe itching, like scabies, pediculosis, and prurigo. Several types are recognized—the common type, where the vesicle appears, becomes purulent, and rapidly dries, forming yellow crusts. This type is much the most frequently seen among school children, in camps, in crowded houses, and wherever there is close association of a number of people. The face, especially in the region of the mouth and nose, is the most commonly affected part, but the neck, scalp, and hands are also frequently involved. The intertrigo type occurs in the flexures, especially the groins, and there the impetigo takes a different form on account of the rubbing of skin surfaces and the warmth and moisture. It is a red, raw, oozing surface, and is usually more resistant to treatment than the common type. The third type is known as the bullous, and in this form, instead of the vesicles rapidly drying up into crusts, they enlarge until blisters of a considerable size are formed. These large blisters become purulent and in time rupture, but the course of this type is much longer than that of the simple variety. Pemphigus neonatorum is now recognized as bullous impetigo of infants, and not a form of pemphigus as once supposed. The treatment of impetigo is remarkably successful even in extensive cases. It is necessary to remove the crusts completely and apply a mild antiseptic ointment. When the condition is secondary to some other skin disease, the latter has also to be treated, and the cure may therefore be slower.

Imphal (imp'hal), an Indian city, capital of Manipur state, with a British political agent, and cantonments. Pop. 67,093.

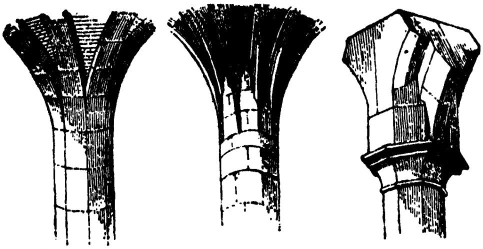
Implu'vium (Lat. *in*, into, *pluo*, to rain), in ancient architecture, a term which denoted, in the houses of the ancient Romans, a basin in the middle of the atrium or entrance-hall, below the *compluvium* or open space in the roof, to receive the rain. See *Atrium.*



Roman Atrium showing Impluvium and Compluvium

Imports. See *Foreign Trade.*

Im'post, (1) a tax, tribute, or duty, particularly a duty or tax laid by Government on goods imported. (2) In architecture, the point of junction between an arch and the column, pier, or wall on which it rests. It is often marked by horizontal mouldings, though these may be absent. Imposts have received various names, according to their character. Thus, a *continuous impost* is where the mouldings are carried down the pier; a *discontinuous impost* where there are no mouldings, but the pier is of a different section from the arch; *shafted imposts* are where the arch mouldings spring from a capital and differ from those of the pier.



Continuous Discontinuous Shafted

Imposts

Impressionism is the term used to describe the aims and methods of a movement in art which originated in France during the nineteenth century and has profoundly influenced modern painting. In the widest sense, Edouard Manet (1832–83), J. M. Whistler (1834–1903), and their followers are the first Impressionists. In revolt against the academic conventions of their day, they sought to represent on canvas the actual visual impression made by an object or scene. To the eye an object appears as a number of tones of different shapes and degrees of light or dark. These are not all seen equally clearly, but with varying distinctness, according as the eye is focused and directed. In painting a subject, therefore, the Impressionists selected the most important of these shapes and tones to an observer, and emphasized them, more or less neglecting the rest. A good example of the method is Manet's *Execution of the Emperor Maximilian*, in the National Gallery. More modern painters of similar tendencies are C. W. Furse (represented in the Tate Gallery), J. S. Sargent, and Sir William Orpen. Another group of artists, almost universally called Impressionist, but better described as Luminarist, was headed by Claude Monet (born 1840), Alfred Sisley (1839 - 99), and Camille Pissarro (1830 - 1903). They likewise aimed at recording accurately the visual appearance of a scene, and employed a method based on the researches of Young and others into the nature of light and colour.

Light falling on an object is broken up to a greater or less extent into its constituent parts (the seven colours of the spectrum), some of which are absorbed and others reflected to the eye. Thus every part of an object reflects to the eye rays of a definite colour, which are combined by the eye. What reaches the eye depends on such factors as the nature of the object, the direction of the light, and the distance of the object. An object can therefore be represented by a number of definite areas of various colours. The Luminarists investigated with much care the exact colour constitution of shadows, half-tones, and high lights; and to reproduce natural conditions as closely as possible used only black, white, and the seven colours of the spectrum. These were not completely mixed on the palette, but were applied in juxtaposed touches of more or less pure colour, which were left to be combined by the eye. This 'divisionist' method partly had its origin in study of the work of Constable, Turner, and Delacroix, who constantly used broken colour (i.e. unmixed on the palette). It was pushed further by the Neo-Impressionists, Seurat (1852–90), Cross (1856–1910), and Signac, who used touches of pure colour of the same size and shape, on the ground that the seven colours of the spectrum combine in equal quantities to form white light. Impressionist aims have met with much criticism not only from academic painters, but from modern artists whose chief concern is with form and its arrangement in rhythmic design (see *Cubism*; *Futurism*). The movement is scientific and analytic rather than artistic and creative. As a whole, Impressionist painters have paid comparatively little attention to the design of their pictures, whose charm lies mainly in pure and harmonious colour and in re-echoing the beauty of nature. Their chief service to art has been in breaking down stifling conventions, in emphasizing the importance to an artist of a close study of nature, and in the development of a new and powerful technical method. The divisionist technique gives a quality and luminosity unobtainable otherwise, and has been freely employed by painters not Impressionist in aim, such as Cézanne, Renoir, and Degas.

Impressment of Seamen, the act of compelling persons, especially seafaring men, to serve in the British navy. The power of impressing seamen, though still existing, has fallen into abeyance since the conclusion of the general war in 1815. Impressment was of ancient date, and uniformly practised throughout a long series of years. It is also recognized in many statutes, such, for instance, as exempted certain persons from impressment, though the power of impressing is not expressly granted in any Acts of Parliament.

Imprisonment, the restraint of a person's liberty, whether in a prison, the stocks, or by merely keeping in custody. It is usually inflicted by way of punishment, the power of sentencing to imprisonment being conferred on certain courts or magistrates, and strictly limited by law. It may be (*a*) imprisonment with hard labour, limited to not more than two years; or (*b*) simple imprisonment in the first division (where the prisoner receives special treatment), in the second division (where the modification of the prison regulations is not so pronounced), or in the third division (where the ordinary regulations receive effect). A person may be imprisoned, however, who is merely accused of a crime, in which case he can generally demand to be released on bail. Imprisonment for ordinary debt is now practically abolished in Britain. See *False Imprisonment*; *Habeas Corpus*.

Impropriation, in the English Church, the transfer of a benefice to the possession of a layman, the annexing of benefices to ecclesiastical corporations being called *appropriation*, though they are sometimes identical. Appropriations were originally annexed to bishoprics, prebends, religious houses, &c.; but on the dissolution of the monasteries in the reign of Henry VIII the appropriations of the several benefices belonging to them were given to the king, and were afterwards granted out from time to time by the Crown. It was after this time that the term *impropriation* was introduced to denote a benefice in the hands of a layman. The appropriator deputed some person to perform divine service in such parish, who, being merely his deputy or vicegerent, was called *vicar*, and his stipend was at the discretion of the appropriator. The distinction, therefore, of a rector and vicar is that the former is entitled to all the ecclesiastical dues of his parish, while the vicar is in effect only the curate of the real parson (the appropriator), and receives but a part of the profits.

I'na, or **Ine**, king of the West Saxons in the seventh and eighth centuries. He succeeded Ceadwalla about 689, and after having obtained advantages over the people of Kent in 694, he turned his arms against the Britons, from whom he wrested Somersetshire and other parts of the west of England. He then made war on the Mercians; but the contest was terminated, without much advantage to either party, by a fierce battle in 715. He resigned his crown and went as a pilgrim to Rome (728), where he passed the rest of his days in devotion. He was one of the principal legislators of the Anglo-Saxons. His laws are the oldest known to us among the Anglo-Saxon kings, except those of the Kings of Kent, and served as the foundation of the code formed by Alfred the Great.

Ina′gua, Great and Little, two islands of the Bahamas, British West Indies, the former low and intersected with lagoons, and affording good pasture land; area, 665 sq. miles; pop. 1100. Little Inagua is quite small; area, 36 sq. miles; pop. about 240.

Inaja′ Palm (*Maximiliana regia*), a South American palm growing to the height of over 100 feet, with leaves 30 to 50 feet long. The spathes are so hard and woody as to serve for cooking food on the fire; they are also used as baskets. The fruit is edible.

Incandescence (Lat. *candescĕre*, to grow hot), the state of a body which glows or gives out light because of its high temperature. Bodies such as a red-hot poker, the mantle in a gas-flame, and the filament of an electric glow-lamp are instances of incandescent solids. The flames of candles, oil-lamps, and ordinary gas-jets are luminous because of the incandescent solid particles which they contain. When a refractory solid is gradually heated, it first gives out invisible heat-waves; when it reaches a temperature of 370° to 470° C., it begins to become visible in the dark, and at a somewhat higher temperature glows with a dull red light. As the temperature rises there is an increase of red light and an admixture of yellow light, and with increasing temperature the spectrum colours are added in turn to the light emitted by the solid, until at some temperature near 1000° C. the body is giving out light of all wave-lengths, and begins to appear white-hot. Further increase of temperature gives a whiter appearance to the light, on account of the increase of the shorter wave-lengths; thus the light from the incandescent carbons of an arc-lamp comes from a source at 3800° C. An incandescent body while giving out light emits also a great proportion of heat; in the most favourable case only about 9 per cent of the total energy radiated from the source is given off in the form of light.

Incanta′tion, a certain formula of words, supposed to have some magical effect, especially if uttered with the accompaniment of certain ceremonies. The use of incantations is extremely old, the magi of Assyria and Babylonia being experts in the art. In ancient Egypt and India there were many magical formulæ in use. In the *Odyssey* ‘ a song of healing ’ is sung over the wound given to Odysseus by the boar. The Second Idyll of Theocritus gives a detailed account of an incantation. A Coan girl named Simætha lays a fire-spell upon her unfaithful lover. She burns barley-meal, bay-leaves, a wax puppet, and some bran, and finally the herb hippomanes and a piece of the fringe of her lover's cloak. As she does so she rotates the magic-wheel (called ‘ wry-neck ’, because originally one of these birds was bound to it) and repeats the formula “ Wry-neck, draw the man to my house ”. This Idyll is imitated by Virgil in his eighth Eclogue, where the formula is “ Draw Daphnis from the city home, draw Daphnis home, my song ”.

Incantations are still common as a part of popular medicine among the uneducated in many parts of England, having descended from the usage of Anglo-Saxon times. Some curious Old-English charms have been preserved; one is a charm to prevent bees from swarming. Earth is to be thrown over them, and the following formula recited:

> Sitte ge, sigewif, sigath to eorthan!
> naefre ge wilde to wuda fleogan!
> beo ge swa gemindige mines godes
> swa bith manna gehwilc metes and etheles!

(Sit ye, victory-wives, sink to earth! Never fly ye wild to the woods! Be ye as mindful of my good as is every man of meat and native-land.) As recently as 1858 it is reported that an old woman in the south-west of England attempted to cure her grandson of the ague by hitting three horseshoes thrice with a hammer and reciting these verses:

> Feyther, Son, an' Holi Ghoast,
> Naale the divil to this poast.
> Throice I stroikes with holy crook,
> Won for God, an' won for Wod, an' won for Lok!

Here the Trinity is invoked, and at the very same time God, Woden, and Loki, who is the spirit of evil. The holy crook, too, is evidently identical with Thor's hammer. Incantations may sometimes have been beneficial in cases of illness, partly owing to the soothing effect of a song constantly repeated in a monotonous voice, and partly owing to the influence which faith has in effecting a cure.

Incarnation. The term, in its specifically religious sense, means the assumption of physical form on earth by a divine being, who exists in this visible tangible form for an ordinary term of life. The idea is widespread among ancient religions, especially in those of Egypt and India. But usually the incarnation is temporary; the deity in question assumes successive forms of incarnation, no one embodiment being final. And the form assumed is not always human; it may be an animal. Examples of both are to be found in Hinduism, ancient and mediæval, where the various and successive incarnations of Vishnu, Rama, and Krishna include both animal and successive human phases. Egyptian religion incarnated deities not only in sacred animals but even in plants, as well as in human beings. Even Greek and Roman religion admitted that deities could sometimes take human form temporarily for special purposes.

In Christianity there is only one incarnation, and it is in human form. This distinguishes

Christianity from other religions; it is the religion of the incarnation, not a religion of incarnations, and incarnation denotes the assumption of a human personality by the divine power. The term is not Biblical, but it goes back to the idea expressed in *John*, i, 14, " The Word was made flesh, and dwelt among us, and we beheld His glory, the glory as of the only-begotten of the Father ". By ' the Word ' (*Logos*) the writer meant the divine power, which, according to the religious philosophy of his age, was the creative organ of God, the reason or spirit which pervaded the world, and was the medium of revelation and fellowship between God and man. It is the Johannine equivalent for the Pauline " God was in Christ ". The assertion that the *Logos* or Word " became flesh " was the new thing; neither Stoicism nor Platonism could have reached this point. As Augustine says in his *Confessions* (vii, 9), " I did not read [in the Neoplatonists] that ' the Word was made flesh, and dwelt among us ' "; their idealism could not embrace this tenet, which, as Augustine rightly saw, was central and distinctive in the Christian religion. The motive for the incarnation is the divine love, which imparts itself to men, by self-sacrifice. " God so loved the world, that He gave His only begotten Son, that whosoever believeth in Him should not perish, but have everlasting life " (*John*, iii, 16). The incarnation is the entrance of God into human life, revealing the full reality of His presence; and this entrance is not by way of emanation, but through a human personality in Jesus. The fourth Gospel does not connect this with the virgin birth; the method is left unexplained. But the stress falls upon the truth of God's direct revelation in Jesus; ' glory ' means the moral and spiritual manifestation of the divine nature, which is visible in Jesus, the Son of God, and which is meant to elicit faith. The object and the motive are brought out in the New Testament, rather than the mode of this realization of the divine in the human. Jesus in His human personality was divine; He completely revealed the divine nature and realized the divine end: this is the essential principle of the incarnation. Through Jesus the divine nature came into personal union with men.

The implicates of the incarnation are the essential affinity of the divine and the human, the innate desire of the divine to be known and received, and the capacity of the human for fellowship with the divine. The truth cuts at the deistic conception of the deity. " We are far too apt to limit and mechanize the great doctrine of the incarnation which forms the centre of the Christian faith. Whatever else it may mean, it means at least this—that in the condition of the highest human life we have access, as nowhere else, to the inmost nature of the divine. ' God manifest in the flesh ' is a more profound philosophical truth than the loftiest flight of speculation that outsoars all predicates, and, for the greater glory of God, declares Him unknowable " (Professor Pringle-Pattison, *The Idea of God*, p. 157), or unattainable. Furthermore, the incarnation implies that religion is not the reach of man's soul to the divine, but the voluntary access of God to man in love and pity; the initiative is with Him, and faith is the human response to the divine revelation in the incarnate deity.

Theologically the doctrine of the incarnation is linked to the doctrines of the Church and the sacraments, in which the extension of the incarnation is sought. The divine Presence, it is argued, is realized through the presence of the living Christ in the Body of the Church and preeminently in the sacraments. But its main theological connection is with the doctrine of the Trinity. Granted that Jesus was the unique and final embodiment of God on earth, what, it is asked, was the relation of the Word or Logos to His personality? That He was simply the incarnation of the divine Spirit is not adequate. Nor is it enough to say (with the Arians) the Logos or Word in Jesus took the place of the soul in man, especially as this Logos was held to be only the highest of God's creatures, not essentially uncreated and divine. The conscious or unconscious instinct in the Church has been to insist that (*a*) the incarnation meant the assumption of all that is in human nature, and (*b*) that it meant the full action of God. Hence the Nicene Fathers often spoke of God becoming man rather than of the Word taking flesh. The title of Anselm's treatise, *Cur Deus Homo ?* (Why did God become Man?), suggests this. For although Anselm in the twelfth century wrote this monograph in order to prove not only that the incarnation was necessary as the one means of atonement, but that the atonement was objectively necessary, his title reflects the interest which underlay the earlier tract of Athanasius, *De Incarnatione Verbi Dei* (On the Incarnation of the Word of God). The incarnation is God taking action in and for mankind, out of love and mercy. The Nicene Creed sums up this belief in the words: " We believe . . . in one Lord Jesus Christ, the Son of God . . . who for us men, and for our salvation came down and was made flesh, entered humanity ".

The question has been raised, whether the incarnation would not have taken place apart from sin? Does not the creation of man, it is argued, imply the further act of the incarnation in order to complete the divine purpose of perfecting humanity in Christ? This is a hypothetical question, and the instinct of the Church, which has never been purely speculative, has contented itself with recognizing that the object of the incarnation was redemptive, and that, in view of the facts of human sin and guilt, the incarnation is intelligible only in the light of the atonement. According to the New Testament, He who atones is He by whom creation was carried out; the Son of God who became incarnate for the purpose of redeeming God's people was the eternal Son by whom God made the world. This is the nexus between the incarnation and creation. Christ, as the *Epistle to the Hebrews* puts it, is the " Son whom He hath appointed Heir of all things, by whom also He made the worlds; who . . . when He had by Himself purged our sins " (i, 2, 3). The relation of Father-Son in the Godhead is, on this view, eternal and essential; the creation is one act of this divine being, the incarnation leading up to the atonement is another, so that, as Athanasius summarily wrote, " He was God and became man, and that to deify us " by means of His redemptive power.—BIBLIOGRAPHY: C. Gore, *The Incarnation of the Son of God*; R. L. Ottley, *The Doctrine of the Incarnation*; J. Caird, *Fundamental Ideas of Christianity*; W. L. Walker, *The Spirit and the Incarnation*; F. Weston, *The One Christ*; P. T. Forsyth, *The Person and Place of Jesus Christ*; H. R. Mackintosh, *The Doctrine of the Person of Christ*; S. A. M'Dowall, *Evolution and the Doctrine of the Trinity*.

Incas, an appellation which the natives of Peru gave to their kings and princes of the blood at the time of the conquest of the country by the Spaniard Francesco Pizarro. Inca means lord or ruler in the Quichua language, and the Incas were the reigning descendants of a conquering tribe or dynasty which, under the leadership of Manco Capac, a ' son of the sun ', united the various tribes into one theocratic state. They ruled the country for over four centuries, from about 1100 to 1533, when the last of the dynasty, Atahualpa, was murdered by the Spaniards. Long before the time of the Incas, however, the country had been inhabited by the Aymaras, and had been a powerful empire, as the archæological remains, such as those at Tiahuanaco, in Bolivia, still testify. The Incas, a warlike tribe living in the great central plateau of the Andes, gradually extended their sway over one region after another, and at last their empire extended from Quito to Chile, and from the Pacific coast to and beyond the Andes. The story of the origin of the Incas is related as follows in the *Chronicle of Peru*: " This country had been a long time the theatre of all sorts of wars, horrible crimes, and dissensions, till at length there appeared two persons, Manco Capac and his wife Mamma Oullo, who gave themselves out as children of the Sun who were sent by Heaven to instruct and civilize the natives. Manco Capac built the city of Cuzco, settled laws and policy, and taught the people to adore the Sun, and he and his descendants took the name of *inca*, which signifies *king*, or great lord. The empire established by the Incas was a theocracy, and the ruler united in his person the highest temporal and spiritual power. He was at once the law-giver, and the law, the representative of divinity, and divinity itself. The Incas were wise and benevolent rulers, and the social laws of the country were most elaborate and equitable. Agriculture flourished, and was the cause of prosperity, as the land was divided among the various clans and owned in common. The inhabitants also excelled in the manufacture of textile fabrics, in weaving, and in the manufacture of pottery. They were excellent road builders, and one of their roads extended from Quito to Cuzco. The Inca Empire reached the summit of its power under Huayna Capac (1475–1525). His successor, however, Atahualpa, lost his empire and his life when the Spanish invaders appeared in 1533."—BIBLIOGRAPHY: Pedro Sarmiento de Gamboa, *History of the Incas*; Garcilaso de la Vega, *Royal Commentaries of Peru*; C. R. Markham, *The Incas of Peru*; W. H. Prescott, *Conquest of Peru*; E. G. Squier, *Travels and Exploration in the Land of the Incas*; Ch. Wiener, *Essai sur les Institutions politiques, religieuses, économiques et sociales de l'Empire des Incas*.

Ince, a parliamentary division of Lancashire, so named from *Ince-in-Makerfield*, forming practically a suburb of Wigan.

Incen'diary Bomb, a form of bomb first used by Germany in the European War. Primarily designed for use from air-craft, it differs from the more usual style of bomb in that its effect does not depend so much on the magnitude of the explosion, but rather on the release of some highly incendiary agents possessing a very powerful and rapid action. Incendiary bombs were chiefly used by the German air-service, in conjunction with the ordinary high-explosive bombs, in order to cause rapidly spreading conflagrations, and so increase the confusion incidental to a raid.

In'cense, aromatic substances burned in religious rites on account of the sweet odour they emit. It was an offering pleasing to the gods, whilst it scared off demons and evil spirits. It was also used for sanitary reasons, and for the purpose of neutralizing the strong odour of bloody sacrifices. The custom of burning incense is ancient and widely spread. Among the Jews the practice was enjoined as part of the worship of the sanctuary (*Ex.* xxx), the ingredients of the incense also being specified, and it was to be burned on a special altar called the *altar* *of incense.* This altar was made of acacia (shittim) wood, and was overlaid with gold, hence it was also called the *golden altar,* as distinguished from the altar of burnt-offering, which was made of brass. The incense was burned daily—morning and evening. In ancient Egypt, Assyria, Babylonia, India, Greece, and Rome incense-burning was part of the worship of the gods, and it is still employed as part of the Buddhist ceremonial. Both the Greek and the Latin Churches use incense in worship, but the practice cannot be shown to have existed among Christians till after the first four centuries. Among Catholics it is used at every high mass, at consecrations of churches, in processions, and at funerals. In the English Church it is only employed by the high ritualistic section, but its use has never been prohibited.—Cf. E. G. C. F. Atchley, *History of the Use of Incense in Divine Worship.*

In′cest, sexual intercourse within the prohibited degrees, which by the laws of England and Scotland are founded on the Levitical code, and include degrees both of consanguinity and of affinity. (Cf. *Lev.* xviii.) In England incest was formerly an ecclesiastical offence left to the jurisdiction of the spiritual courts. Now it is a misdemeanour, punishable by penal servitude for not less than three nor more than seven years, or by imprisonment not exceeding two years. In Scotland and some of the United States it is a criminal offence also. In Scotland it was punishable with death till 1887.

Inch (Lat. *uncia*), a measure of length, $\frac{1}{12}$ of a foot. By a statute of Edward II, an inch was defined to be the length of three grains of barley, placed end to end. Engineers use the symbol ″, e.g. 2′ 6″ = 2 feet 6 inches.

Inch′bald, Elizabeth, English novelist and dramatic writer, born 1753, died in 1821. She married the actor Inchbald, who died in 1779. She continued on the boards about eight years, but retired from the stage in 1789, and devoted herself to literary pursuits. She wrote, among other works, two novels, which display much original thought and genuine pathos—the one entitled *A Simple Story* (1791), the other *Nature and Art* (1796). She edited *The British Theatre,* a collection of dramas, with biographical and critical remarks (25 vols., 1806–9); a collection of farces (7 vols.); and the *Modern Theatre* (10 vols., 1809).—Cf. R. S. Littlewood, *Elizabeth Inchbald and her Circle.*

Inchcolm (insh-kōm′), a small island of Scotland, in the Firth of Forth, off the coast of Fifeshire, with the ruins of a monastery founded by Alexander I in 1123, of which Walter Bower, the continuator of Fordun, was abbot from 1418 to 1449.

Inchkeith (insh-kēth′), a small island of Scotland, in the Firth of Forth, off the Fifeshire coast, with a lighthouse visible for 21 miles.

Inclined Plane, a plane forming with the horizontal plane any angle whatever excepting a right angle. It is one of the mechanical powers by which a small force under certain conditions is used to overcome a greater force. When a body lies on an inclined plane, part of its weight is supported, so that if a cord be fastened to it and pulled, a force less than the weight of the body acting in a direction parallel to the plane will prevent it from sliding, or will move it up the plane. Thus a heavy wagon is raised on an inclined road by a horse which would be quite unable to exert a pull equal to a quarter of the weight of the wagon. Neglecting friction, the force parallel to the plane necessary to raise the body is equal to the weight of the body multiplied by the vertical height through which it is lifted, divided by the distance it is moved along the plane. See *Statics.*

Inclinometer. See *Dipping-needle.*

Inclosure Acts, Acts passed, some of them many centuries ago, to enable waste or common lands to be enclosed and occupied by private persons, the idea being that it was a benefit to the public at large that as much land as possible should be brought under cultivation, provided public rights in such lands were not wholly disregarded, which was often the case. Common or waste lands are still liable to enclosure, but public rights are now more carefully guarded, and a sufficient case has to be made out before the Board of Agriculture, the claims of all parties being considered and satisfied, and the settlement being sanctioned by Parliament.

In Cœna Domini, a Papal Bull, so called from its first words, it being annually read ‘at the Lord's Supper’ on Holy Thursday. Its earliest form was that promulgated in 1363 by Urban V anathematizing all heretics and favourers of heretics without distinction. The Bull was afterwards extended and modified by several Popes to include those who imposed taxes upon the clergy for the needs of the State, and in its latest form (promulgated by Urban VIII in 1627) specially anathematized all Hussites, Wycliffites, Lutherans, Calvinists, and Unitarians; all schismatics, pirates who disturbed the Papal seas, forgers of Papal letters; and all who should attack or conquer the Papal territory. The Bull was annually promulgated at Rome till the year 1770, when a much modified document took its place, this in its turn being withdrawn by Pius IX in 1869.

Income Tax. *History.*—Income tax in its modern form was introduced by Pitt in 1798. It was withdrawn in 1799, and a duty of 10 per cent on incomes was imposed. The modern form was again imposed in 1803 under Addington's

Government, when the practice of charging incomes at the source was introduced, and continued until 1816 to meet the expenditure of the Napoleonic wars. It was revived in 1842, and, notwithstanding efforts and promises to have it abolished, it has been maintained to the present time, and is now an indispensable source of public revenue. Originally all incomes exceeding £60 were chargeable, but between 1842 and 1920 the exemption limit varied thus: 1842 to 1876, £100; 1876 to 1894, £150; 1894 to 1915, £160; 1915 to 1920, £130. In 1907 a graduated scale of tax and differentiation between earned and unearned incomes were introduced. Abatements continued to be granted up to a certain limit of income (1899 to 1920, £700). The 'normal' or maximum rate of tax rose from 2*d.* per £1 in 1875 to 1*s.* 2*d.* in 1914. Shortly after the outbreak of the European War it was further increased to 1*s.* 8*d.*, and as the need for money became greater it rose to 3*s.* in 1915, 5*s.* in 1916, and 6*s.* in 1918. For the fiscal year 1921–2 the estimated yield of the income tax (including super tax and mineral rights duty) is nearly 34 per cent of the total revenue of the United Kingdom. The Income Tax Act, 1918, consolidated the law, while on the recommendation of a Royal Commission radical changes were made by the Finance Act, 1920.

The Meaning of 'Income' in 1921.—Income does not include (*a*) capital appreciation, e.g. stock-exchange gains; (*b*) gifts; (*c*) official residences or free residences not lettable; (*d*) cooperative 'dividends' on purchases; (*e*) profits from the produce of garden allotments; (*f*) interest on Savings Certificates; (*g*) wound and disability pensions and gratuities to the fighting forces; but the term does include other interests, dividends, rents, feu duties, business profits, wages (including bonuses), deferred pay, pensions generally, compensation for loss of office, perquisites of office paid in or convertible into money, &c. In the case of dividends paid 'free of tax', the income is the gross sum from which tax at the normal rate must be deducted to give the actual amount received. When a death, marriage, divorce, change of partnership, &c., occurs during a fiscal year (6th April to 5th April), the income for the period prior to the date of such event is a year's income for tax purposes.

Computation of Profits in 1921.—Income is dealt with in five classes or schedules, according to the sources from which it is derived. Schedule A comprises income from the ownership of land and buildings, the assessment being made on a fictitious income consisting of the rental or annual value less (*a*) one-sixth for repairs, &c., for buildings, and one-eighth for land; (*b*) land tax; (*c*) such burdens as ground rent, mortgage interest, &c.; and (*d*) in Scotland owner's local rates.

Schedule B deals with profits from the occupation of land, i.e. farming. The assessment is made on double the annual value or rent, unless the farmer claims to be assessed under Schedule D *infra.*

Under Schedule C fall interests, annuities, &c., paid out of the public revenue, the tax being deducted at the time of payment, except in certain small half-yearly dividends not exceeding £2, 10*s.*

Schedule D is divided into six Cases. (1) Trades, manufactures, and businesses assessed for any fiscal year on the average profits of the three preceding years ending on 5th April, or on the nearest date thereto to which the accounts have been made up. Allowable deductions from the profits of each year are the rent or net annual value (Schedule A assessment) of the business premises, bad debts, a fair proportion of doubtful debts, cost of alteration of premises (but not of improvement), repairs and renewals less salvage, insurance premiums other than life premiums, interest paid to bankers, interest, &c., received less tax, Excess Profits Duty, Corporation Profits Tax, and generally all expenses necessarily incurred in earning the income; but partners' salaries and drawings, interest on capital, annual interest or other outgoings (from which tax should be deducted), income tax paid, all expenditure of a capital nature, &c., must be added back to profits. Manufacturers and traders may claim an allowance for wear and tear of plant and machinery. Tax deducted from interest, feu duties, &c., paid must be accounted for. (2) Professions, employments, and vocations not charged under other Schedules; also assessed on the average system as in Case (1). (3) Interest and profits of an uncertain annual value not charged under Schedules A and C, e.g. interest on certain War Loan Stocks, discounts, &c., received without deduction of tax; assessed on the profits of the preceding year. (4) Colonial and foreign securities (mortgages, debentures, and the like) assessed on the income of the year of assessment, whether remitted to the United Kingdom or not, or, in the case of persons not domiciled nor ordinarily resident here, on the sums remitted here in the year of assessment. (5) Colonial and foreign possessions: (*a*) businesses wholly conducted abroad assessed on the profits brought to the United Kingdom on the three years' average; and (*b*) stocks, shares, and rents assessed as in Case (4), but with the benefit of the three years' average. (6) Annual profits not charged elsewhere, e.g. from furnished lets, assessed on the actual or the average profits as the Commissioners direct.

Schedule E covers employment under companies, societies, and corporations, and the

Crown. The assessment is on the actual profits of the year; but subordinate employees obtain the benefit of the average system. Under Schedule E, 'weekly wage-earners' employed by way of manual labour are assessed quarterly, except draughtsmen, clerks, and typists, &c.

Computation of the Tax in 1921.—The income ascertained, the liability must then be determined. For tax purposes a wife's income must be added to, and reckoned as, her husband's. From earned income there is allowed a special deduction of one-tenth, with a maximum of £200. To the net earned income is added the gross unearned or investment income, and the total is known as the 'assessable income'. If the assessable income does not exceed £135 in the case of an unmarried person or a widower or widow, and £225 in the case of a married person whose wife is living with or separately maintained by him, there is no liability. Otherwise, to find the taxable income certain deductions are allowed: (1) a personal allowance of £135, and a further allowance of £90 if the taxpayer maintains or is living with his wife, plus nine-tenths of any earned income of the wife up to a maximum of £45. (2) £36 for the first child, and £27 for each other child (including step-child and adopted child) under sixteen years on 6th April of the fiscal year, or, though over such age, in full-time attendance at an educational establishment, and not receiving annually in his or her own right more than £40 exclusive of scholarships and bursaries. (3) £45 for a female relative of the taxpayer (widower or widow), or if no relative is available, any other person living with the taxpayer for the purpose of taking charge of any child for whom the foregoing allowance may be claimed. An unmarried person has a like deduction if the child is a brother or sister. (4) £25 in respect of (*a*) any aged or infirm relative maintained by the taxpayer; (*b*) the widowed mother maintained by the taxpayer; and (*c*) a daughter resident with and maintained by the taxpayer, upon whose services he or she depends from old age or infirmity. In cases (*a*) and (*b*) the dependent's own income must not exceed £50. The term 'relative' includes relatives by marriage and adopted children.

The taxable income so ascertained is chargeable on the first £225 thereof at one-half the standard rate, and on the excess at the full standard rate. For 1921 the standard rate is 6*s.* per £1.

Life Assurance Relief.—A remission of tax may be claimed on premiums paid on assurances on the life of the taxpayer or his wife up to one-sixth of the total income and 7 per cent of the sum assured exclusive of bonuses. The relief is, in the case of policies effected before 23rd June, 1916, (*a*) 3*s.* per £1 of premiums within said limits if the total income does not exceed £1000; (*b*) 4*s.* 6*d.* if it exceeds £1000 but not £2000; and (*c*) 6*s.* if it exceeds £2000; and in the case of all policies effected on or after that date, 3*s.* The premiums are not a deduction from assessable income, but the relief is deducted from the tax as ascertained under the rules above set forth.

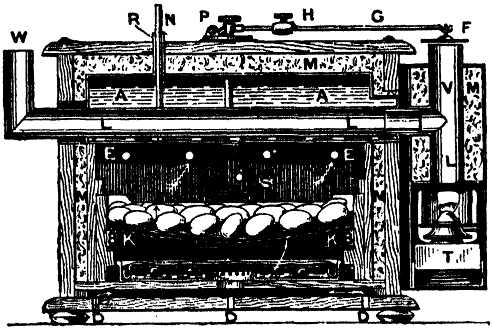
The Position of Non-residents.—Individuals not resident in the United Kingdom have no rights of relief from British income tax (except in the case of interest on certain Government Stocks) unless they are: (*a*) British subjects; (*b*) in the service of the Crown or a missionary society or British protectorate; (*c*) resident in the Isle of Man or Channel Islands; (*d*) resident abroad for reasons of health after residence in the United Kingdom; or (*e*) the widows of persons who were in the service of the Crown.—BIBLIOGRAPHY: W. E. Snelling, *Taxation*; *Income Tax and Super-tax Practice* (4th edition); S. Dowell, *History of Taxation and Taxes in England*; *The Acts relating to Income Tax*; *Your Income Tax* (Nelson & Sons).

Incommen'surable, in mathematics, a term applied to two magnitudes when they cannot both be measured by the same quantity, that is, when there is no unit which they both contain exactly. The diagonal and side of a square are incommensurable.

Incuba'tion (pathology), the period between the infection and the outbreak of the disease. During this period the organisms that cause the disease are growing, multiplying, and forming the poisonous substances or toxins that will attack the tissues and excite the symptoms of the disease. Before these specific indications of the nature of the ailment manifest themselves the toxins cause only such general symptoms as loss of appetite or sleep, &c. In epidemic and contagious diseases the period of incubation is well defined.

Incubation, the mode in which birds commonly bring forth their young, that of sitting on the eggs till they are hatched by the natural heat of the body. In general it is the female which undergoes the labour of incubation, but among some species, chiefly of monogamous birds, the male relieves the female while she seeks her nourishment; in others the male feeds her. Some birds, like the cuckoo, abandon their eggs to be hatched by others. In a state of nature birds generally commence to sit in spring. The time of incubation varies with different species, but is always the same with the same species. In the humming-birds it is 12 to 14 days; in the swallow and lark, 15; the canary, from 15 to 18; crow, 20; common hen, 21; pheasant, partridge, &c., 22; peacock and turkey, 30; swan, 40–45; cassowary, 62.—*Artificial incu-*

bation, the hatching of eggs by prolonged artificial warmth, has been long practised amongst the Egyptians and Chinese. Tank and hot-air incubators are largely used by modern poultry-farmers.



Section of Hearson's Incubator

AA, Tank of water. BB, Movable egg-tray. CC, Water-tray. DDD, Holes for fresh air. EE, Ventilating holes. F, Damper. G, Lever. H, Lead weight. KK, Slips of wood. LLL, Lamp chimney and flue-pipe. MMM, Non-conducting material. N, Tank thermometer. O, Needle for communicating expansion of capsule S to lever G. P, Milled screw. R, Filling tube. S, Thermostatic capsule. T, Petroleum lamp. V, Chimney for carrying away surplus heat. W, Chimney for discharge of residual products of combustion.

In'cubus, a spirit or demon, to whom was formerly ascribed the oppression known by the name of *nightmare.* These demons play a somewhat important part in the superstitions of the Middle Ages. They were supposed to haunt women in their sleep, and the birth of witches was attributed to their visits. The corresponding female spirit was the *succuba.*—Cf. E. B. Tylor, *Primitive Culture.*

Incum'bent, in England the holder of a benefice (rector or vicar); in Scotland an episcopal clergyman. An incumbent holds for life, and may be removed only if he commits a grave ecclesiastical or moral fault.

Incunab'ula, a term applied by bibliographers to editions of books printed during the early period of the art, and generally limited to works which appeared previous to 1500. The number of incunabula is supposed to be over 20,000.

Indem'nity (Lat. *in-*, negative, *damnum,* loss), a term frequently employed in politics and jurisprudence. It is used in various significations, but is usually applied to an Act of the legislature passed for the purpose of relieving individuals, especially in an official position, from the penalties to which they may have rendered themselves liable by some violation of the law whether by act or omission, or in case of members of Government in consequence of exceeding the limits of their strict constitutional powers.

Inden'ture (Lat. *indentare,* to cut into teeth), a deed entered into between two or more parties, and so called because duplicates of every deed between two or more parties were once written on one skin, which was cut in half, with a jagged or indented edge; so that when the duplicates were produced in court they were seen to belong to each other. See *Apprentice.*

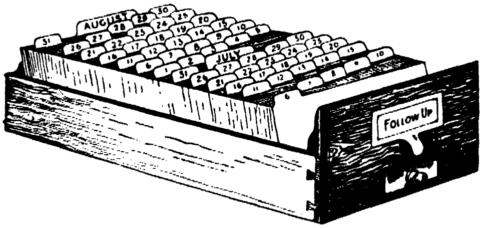
Independent Labour Party (I.L.P.), British Socialist organization (not to be confused with the British Labour Party), founded at Bradford on 13th Jan., 1893, at a conference presided over by Keir Hardie. The original purpose of the I.L.P. was to secure direct parliamentary representation for the trade unions, and eventually to obtain collective ownership of the means of production. One of the most influential Socialist organizations at the beginning of the twentieth century, the influence of the I.L.P. was gradually weakened by the British Labour Party and the Nationalist Socialist Party. Since the Russian Revolution of 1917 and the establishment of Bolshevism and of Soviet government in Russia many adherents of the I.L.P. adopted purely communistic ideas, and the left wing seceded in March, 1921. During the European War the I.L.P. energetically advocated a cessation of the war and a speedy peace, and thus became rather unpopular.

Indeterminate Analysis, or **Diophantine Analysis** (see *Diophantus*), in algebra, deals with the solution of equations, the number of which is less than the number of unknown quantities. The number of solutions of a system of this kind is, in general, infinite. In many problems, however, some restriction is placed upon the values of the unknowns, e.g. they may have to be positive integers, and then the number of solutions may be finite, or there may even be no solution at all. As an example, we may take the question: How may a sum of £1, 3*s*. 6*d*. be paid in florins and half-crowns? Let x = number of florins, y = number of half-crowns. Then $4x + 5y = 47$; $x + y + \frac{1}{4}y = 11 + \frac{3}{4}$; $(y - 3)/4 = 11 - x - y$ = an integer, say p. Then $y = 4p + 3$, and, from the original equation, $x = 8 - 5p$. Since y is positive, p must be positive; and, since x is positive, p must not be greater than 1. Hence the only solutions are those for which $p = 0, 1$. Thus $x = 8, y = 3$; or $x = 3, y = 7$.

Diophantine equations may be of any degree. A specially interesting example is the quadratic $x^2 + y^2 = z^2$, which has an unlimited number of integral solutions. It may, in fact, be verified at once that the equation is satisfied if $x = a(k^2 - 1)$, $y = 2ak$, $z = a(k^2 + 1)$; where a, k are any positive integers. The similar equation $x^3 + y^3 = z^3$ can be proved to have no integral solution. *Fermat's Last Theorem* asserts that the equation $x^n + y^n = z^n$ has no integral solution if n is a positive integer greater than 2. Only special cases of this theorem have so far been proved, and a large money prize awaits the discoverer of a complete proof.

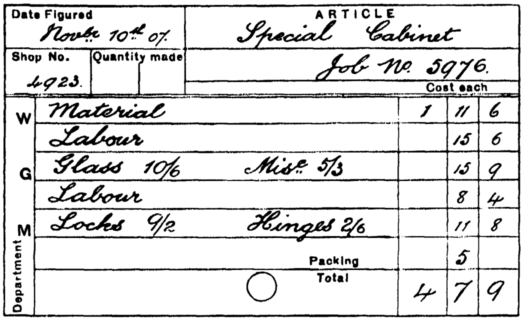
Indeterminate Forms, or **Undetermined Forms**, in general mathematical analysis, are analytical expressions the value of which cannot be calculated, some operation being involved which is excluded by the laws of algebra, e.g. $0 \div 0$; $\infty \div \infty$; $0 \times \infty$. An indeterminate form has, strictly speaking, no value. When, however, the indeterminateness only arises when a variable which occurs in the expression is given one particular value, we can find the limit to which the value of the expression tends as the variable tends to this particular value; this *limit* is usually taken as the *value* of the indeterminate form. *Example*: $(x^2 - 4x + 3)/(x^2 + 5x - 6)$, when $x = 1$, takes the form $0 \div 0$. But the expression may be written $\{(x - 1)(x - 3)\}/\{(x - 1)(x + 6)\}$, and, *so long as x is not equal to* 1, we can divide numerator and denominator by $x - 1$, Hence the *limit* of the fraction, as x tends to 1, is the same as the limit of the fraction $(x - 3)/(x + 6)$, viz. $-\frac{2}{7}$.—Cf. G. A. Gibson, *Treatise on the Calculus.*

Indexing. There are two main systems of indexing, and these may be described as the *book* and the *card* systems respectively, both of them existing in several modified but distinct branches, although the former is apparently being merged gradually in the card index, and few if any compilations appear nowadays in book form that have not been, either wholly or partially, constructed by its assistance. Loose-leaf ledgers, for example, are merely card index modifications. By a further classification, a system may be termed *automatic*, *collective*, or *automatic and collective*. The card index is automatic; the book index may be either collective or automatic, but generally expresses the result of an automatic system, when it would be described as automatic-collective. The thumb index found in books is an automatic index, but does not carry the advantages of unlimited expansion which forms such a prominent feature of the card index and its modifications. Again, indexing may be *alphabetical*, *numerical*, *by subject*, or *mechanical*, but the latter is applicable only to the card index.



Card Index for 'Follow-up' System

An encyclopædia is a good example of an automatic-alphabetical index, as is also a dictionary, but it has now become customary to issue an appendix to every encyclopædia as a collective-alphabetical index, not by reason of any breakdown in the automatic system, which is the simplest and best, but because of the modern tendency towards the embodiment of complete and authoritative treatises in the text. Towards this end it is necessary to dissect the subject matter and to place each subdivision under its respective alphabetical title, linking up these subdivisions into a complete survey of the disembodied article through the collective index in the last volume. This is especially a necessity where a subject or part of a subject may be described in one of several ways, and is a powerful recommendation for card indexing which embodies a special cross-reference system whereby any subject may be traced, provided it has been expertly indexed.



Date Figured Novr. 10th 07.		ARTICLE Special Cabinet			
Shop No. 4923.	Quantity made	Job No. 5976.			
			Cost each		
W	Material		1	11	6
	Labour			15	6
G	Glass 10/6	Misc. 5/3		15	9
	Labour			8	4
M	Locks 9/2	Hinges 2/6		11	8
Department		Packing		5	
	○	Total	4	7	9

Example of a Card for Card Cabinet, showing Cost Record

General Indexing.—Book indexing is self-explanatory, and all the principles are embodied in the card index, which is mainly dealt with here.

The card index in its simplest form consists of a box (as illustrated) containing a series of standardized cards, and indexed by means of *guide cards* which are specially made, and usually carry a small slip or extension which projects above the standardized cards and affords a ready means of location. It is thus capable of expansion by the addition of cards or by the multiplication of boxes, and it has the advantage that, supposing it were used for correspondence, 'live' matter only need be allowed to remain 'in action', as contrasted with registers where completed correspondence ('dead') cannot be segregated, a mass of unnecessary data accumulating daily and obstructing a rapid investigation of fact, which tends not only towards a general slowing down, but also towards a much depreciated efficiency, and is usually accompanied by a rapid increase in working expenses.

Numerical Indexing may be simple or complex, simple where the card numbers run consecutively, and complex where a *guide number* is modified by another *sub-number* or letter.

Examples: Card No. 1 is completed, and a second card is employed, numbered 1/2; a third would be 1/3, and so on. Alternatively a card would be No. 1, and others would be 1/*a*, 1/*b*, &c. Again, card No. 1 might have a distinctive colour, as opposed to the sub-numbered cards; or a *guide card* can be employed to represent the initial card, standardized cards representing the subdivision.

Mechanical Indexing is invariably accomplished by means of a power machine which perforates cards in special spaces, each perforation being distinctive in shape or dimensions, and indicating definite established facts.

Example: A large hospital registers the treatment of infectious cases by mechanical indexing. The Public Health Officer is desirous of a return showing the number of scarlet fever cases admitted during an epidemic, and the distinctive perforation for scarlet fever is △. The cards for the entire hospital are merely run through the machine, and those bearing this perforation are sorted out from all the others, enumerated afterwards or counted by the machine.

Subject Indexing demands the use of *guide* and *cross-reference* cards.

Example: A firm trades with a hundred other firms in London. Each of those firms is accommodated with a *guide card*, and a précis of all correspondence received or dispatched is recorded upon the *standardized cards* in the spaces provided therefor. The correspondence refers merely to two distinct classes of soap—washing-soap and toilet-soap, and each of these has a *guide card* accordingly, with a *cross-reference* upon *standardized cards* to the correspondence passing between the firm in question and the hundred others.

Alphabetical Indexing is almost self-explanatory. A *guide card* represents each letter of the alphabet, and subjects are indexed alphabetically, with cross-references to another letter where a description might be ambiguous in its meaning.

Example:
Subject—Card Index.
Guide Card—Card Index under 'C'.
Cross-reference—Index, Card (see Card Index) under 'I'.

The examples are necessarily elementary, but are representative of indexing in its many commercial and professional ramifications. Elaborate systems provide for thousands of index cabinets, including cabinets for all kinds of miscellaneous emergencies, and a special system for keeping correspondence especially, thoroughly up to date. There is no system so accurate, so reliable, or so simple as the card index, but in its operation it demands care, intelligence, neatness, and general efficiency to a maximum degree. Any minor carelessness in entering matter upon a card or inadequately cross-referencing will suffice to cause absolute chaos, not only throughout the system, but in regard to the matter to which, if properly kept, it ought to afford a perfect key. —BIBLIOGRAPHY: A. L. Clarke, *Manual of Practical Indexing*; M. Petherbridge, *The Technique of Indexing*; H. B. Wheatley, *How to make an Index*; G. E. Skerry, *Indexing and Précis Writing*.

Indexing, Specialized. The card index system has been extensively applied in both naval and military administration, but the system has undergone considerable modification to admit of an almost perfect specialization in definite subjects exclusive to the navy and army. Special cards are issued to army offices, and these are subdivided as for ordinary précis indexing, but bear on the top an extra series of spaces for special entries, plus a triangular space, which is cut off when the card is completed.

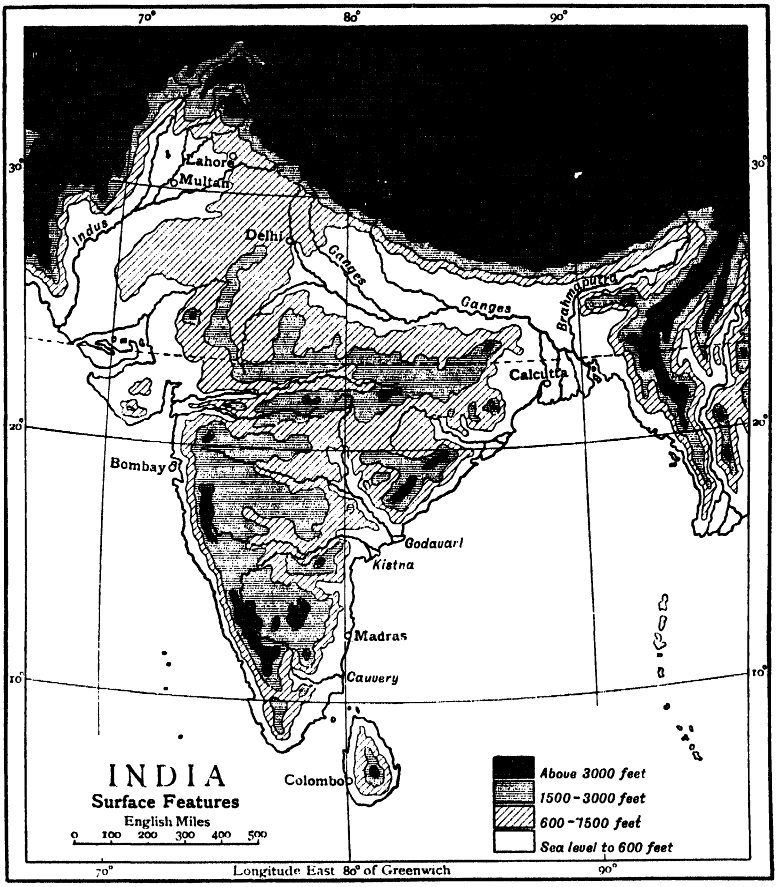
Index Librorum Prohibitorum ('list of prohibited books'), in the Roman Catholic Church, a title used to designate the catalogue or list of books prohibited by ecclesiastical authority, on account of the heretical opinions supposed to be contained in them, or maintained by the authors or editors of them: when the list or catalogue is of books allowed to be read after correction or alteration, agreeably to the orders of the Papal authorities, it is termed *Index Expurgatorius.* Such prohibitory catalogues have been in use from a very early period in the history of the Church, commencing with a list of prohibited books drawn up by a council held at Rome in A.D. 494, or even earlier with the proscription of the writings of Arius. These prohibitions, in fact, were often issued by other than the Papal authorities. In 1408 a synod at London prohibited the reading of the books of Wycliffe. In 1544 the Faculty of Theology in Paris published a catalogue of books censured by them, and in 1546 the University of Louvain published an index of books regarded as dangerous. The indexes of the Church were a subject of consideration at the Council of Trent, which referred the business of drawing up a complete index to a select committee under the Pope. Their Index was published in 1564, and besides the catalogue of prohibited books contains general rules relative to such books. In 1586 a special ecclesiastical board, the Congregation of the Index, was formed, consisting of a cardinal-prefect, with other cardinals and examiners of books, with authority to judge of new works, to indicate those of which the reading is entirely prohibited, and those which are permitted after correction, and also to grant to learned and pious men the right of reading prohibited works. The most important editions are those of Alexander VII in 1664, and of Benedict XIV in 1753. Under Leo XIII an entirely new Index was drawn up in 1900, and reprinted under Pius X in 1904 and 1907. In 1607 the first volume of an *Index Expurgatorius* was published at Rome, edited by the Dominican Brasichelli. In Spain the Inquisition maintained its right to issue its own index, the last edition of which, dated 1790, was reprinted, with a supplement in 1805. The Spanish indexes, which are mostly both prohibitorial and expurgatorial, contain most of the books found in the Roman index and many others besides. The Congregation of the Index may give permission to any Roman Catholic to read and to keep prohibited books.—BIBLIOGRAPHY: T. Hurley, *Commentary on the Present Index Legislation*; A. Boudinhon, *La Nouvelle Législation de l'Index*.

Index Numbers are a device for measuring the average variation in price of a number of commodities, chiefly used to compare the purchasing power of money at different times or places, or to throw light upon some general tendency affecting all prices, such as a change in the amount of currency in circulation. When prices are quoted in different ways—wheat by the bushel, coal by the ton, milk by the gallon, and so on—these prices are incomparable, and an average of them has no meaning. But if the price of a number of articles each be expressed as a ratio of its price at a given time (or of its average price over a given period), known as the base, numbers so obtained for each article can be compared and an average taken. The usual plan is to calculate each price as a percentage of the base, and to combine the results by taking an arithmetic average; but sometimes a geometric mean is used. In the *Statist* index numbers (formerly known as Sauerbeck's) the prices at different times of forty-five articles are represented by a percentage of their average price from 1867 to 1877, and are combined by an arithmetic average. The commodities chosen for an index number depend on its purpose. An index number for measuring changes in the purchasing power of money should theoretically cover a large number of articles, but in practice a selection of a number of staple commodities is found sufficient. The prices taken are usually wholesale market prices (as in the *Statist* number), or declared values in foreign trade. Index numbers of retail prices or wages are rarely satisfactory, as it is difficult to be certain that the same thing is being paid for at different times or places. Nevertheless, since 1915 the Ministry of Labour has issued an index number designed to measure the average increase in the cost of maintaining the pre-war standard of living of the working classes, based on the actual prices paid for food, clothing, rent, fuel, and light. This number is open to grave theoretical objections, but is of considerable practical importance, as it has formed the basis for many recent wage agreements. For an index number designed to show the influence of a force affecting all prices, the relative importance of the articles chosen need not be considered. Thus Jevons, in his famous calculations to discover the effect in prices of the gold discoveries during the nineteenth century, simply took a geometric mean of the percentage variations in price of thirty-nine selected articles. In other index numbers some form of 'weighting', according to the importance of the article in consumption or in business, is usually adopted. This may be done roughly by including more important articles in several forms or stages of production, e.g. wheat and flour, iron and steel, and in practice this is found sufficiently accurate, as compared with more elaborate methods. The *Statist* number, which extends from 1846, is one of the most useful for general purposes. The special purpose of Jevons's numbers (to be found in his *Investigations in Currency and Finance*) must be borne in mind, but it has the advantage of going back to 1782. The *Economist* index number, first published in 1868, originally covered twenty-two articles, and now includes forty-four articles. The Board of Trade index number runs from 1871, and is based on the declared import and export values of forty-five articles. The method of index numbers can be applied to statistics other than prices, where things otherwise incomparable have to be compared and combined. For example, a number representing the total amount of work of every kind done in a factory at a given time can be calculated. At present, however, this application is of no great public importance. Below are the *Statist* numbers and the Ministry of Labour Cost of Living numbers for recent years.

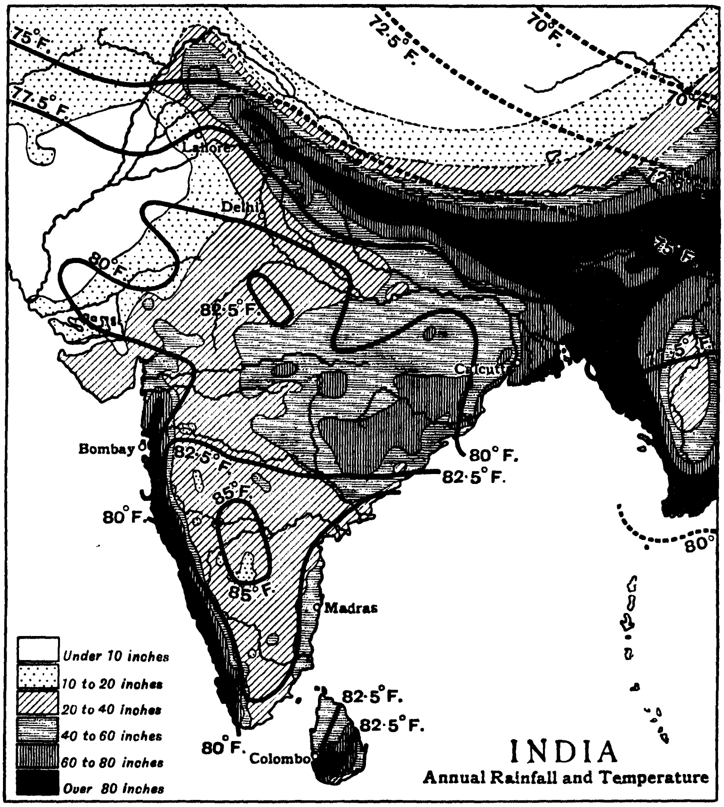
	1915.	1916.	1917.	1918.	1919.	1920.	1921.	1922.
Statist (Wholesale Prices) (1867–77 = 100) ..	108	136	175	192	206	225	155	(Jan.) 132.5
Cost of Living (January) (July, 1914 = 100) ..	110–115	135	165	185–190	220	225	265	192

Statist Index Numbers, and Ministry of Labour Cost of Living Numbers

India, a name properly applicable to the whole of the British Indian Empire, which includes Burmah, but popularly restricted to the great central peninsula of Southern Asia. It forms an irregular triangle, separated from the rest of Asia by the almost impassable ranges of the Himalaya, the Hindu Kush, and Suleiman Mountains, and by the Indian Ocean. Its length north and south, and its greatest breadth east and west, are both about 1900 miles. India may be regarded as consisting of three separate regions, well defined by differences of soil, climate, production, and population. The first is the region of the Himalaya. Immediately south of the Himalaya lies the vast North Indian Plain, containing the most fertile and densely-populated portions of the empire. South of the northern plain rises the third region of India, the triangular plateau of the Deccan, which has a general elevation of from 2000 to 3000 feet. Its northern scarp is formed by a number of hill ranges known as the Vindhya Mountains. The other two sides of the Deccan are formed by the Eastern and Western Ghâts, which stretch southwards along the eastern and western coasts of India, the latter rising in the Nilghiris or Neilgherries to the height of 8760 feet. (See *Ghâts.*) The vast North Indian Plain is watered by three distinct river systems, which collect the drainage of both the northern and southern slopes of the Himalaya. The first of these systems rises on the northern side of the Himalaya, and makes way through their western ranges into the Punjab as the Indus and Sutlej. The second rises in the same quarter, not far from the sources of the Indus and Sutlej, but flows in an opposite direction, and enters India on the east as the Brahmaputra of Assam and Eastern Bengal. As these two systems convey to India the drainage of the Tibetan slopes of the Himalaya, so the third



system, the Ganges, with its tributary the Jumna, drains the southern slopes; traverses the central part of the Indian plain; unites near its mouth with the Brahmaputra, and forms the immense delta known as the Sunderbunds. The Ganges for thousands of years has occupied a prominent place in Indian civilization, and was the sole channel of traffic between Upper India and the seaboard until the opening of the railway system in 1855. In the Deccan the Nerbudda and Tapti carry the drainage of the southern slopes of the Vindhyas into the Gulf of Cambay; and the Godavari, the Kistna (Krishna), and Cauvery rise in the Western Ghâts, and traverse the whole of the central tableland, reaching the sea on the eastern shores of the peninsula. The Indian rivers in the lower portions of their courses afford a natural system of irrigation, but in the higher parts an extensive system of canal irrigation is required. The Ganges and Jumna canals alone irrigate an aggregate area of about three million acres. The coasts of India have very few indentations, and consequently few good natural harbours. There are no lakes of any extent, Chilka and Kolair on the east coast being the largest.



INDIA
Annual Rainfall and Temperature

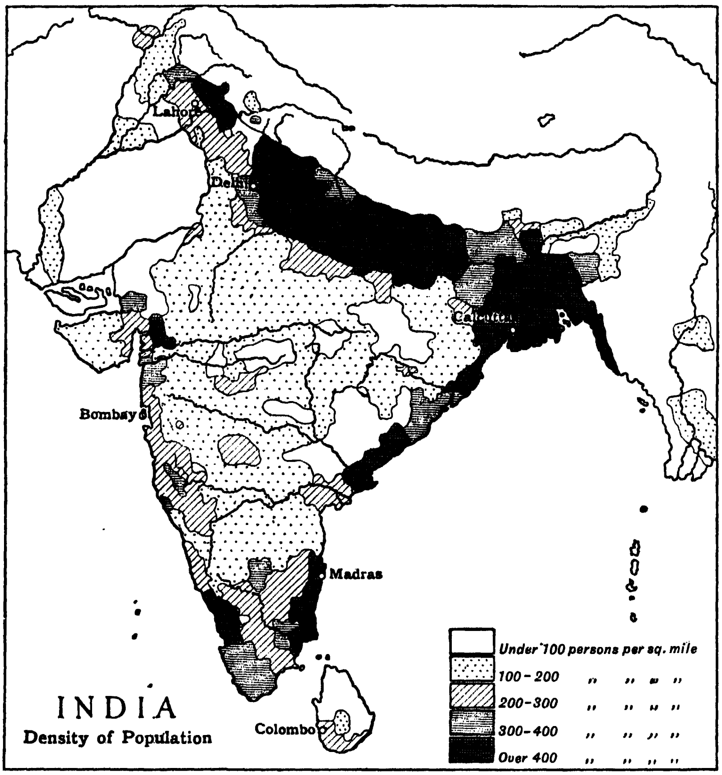
Climate.—In Southern India the climate, of course, is tropical, and generally the heat is very great. Among the higher elevations of the Himalaya an Alpine climate prevails. The Indian plains are, especially in summer, sultry, unhealthy, and partly barren. The Deccan and the slopes of the Himalaya enjoy a temperate climate. The climate of the Nilghiris is healthy and pleasant, and several sanatoria for Europeans have been established there, as well as on the Himalaya. Throughout the entire country there are only two annual seasons, the dry season and the rainy season. The rainfall chiefly depends upon the *monsoons.* The south-west monsoon, which lasts from May till November, usually brings much rain from the Indian Ocean; the north-east monsoon lasts from November till March, but is much less rich in moisture; and the whole rainfall is distributed with great irregularity.

Flora and Fauna.—The flora of India offers nothing very distinctive. In the Himalaya it has to a considerable extent a European character; in the south it is tropical. Many plants of temperate climates, such as wheat, barley, and European vegetables, are grown in the north-western and other parts, while various products of warmer regions are also cultivated, such as cotton, rice, indigo, oil-seeds, jute, tobacco, sugar-cane, coconut, date, and other palms, and spices. Coffee, tea, and cinchona are now extensively cultivated in India, the first particularly on the slopes of the Western Ghâts and in the Nilghiris. The tea-plant is also grown in the south, but especially in Assam and along the lower slopes of the Himalayas. European fruits abound, and among cultivated fruits may be mentioned the mango, plantain, pomegranate, citron, orange, lime, melon, fig, almond, pineapple, guava, jack, and tamarind. Amongst trees the teak forests under the protection of the Government are of most economic value. The bamboo, the banyan, the sappan, and the saul are all characteristic of Indian forest scenery. In Bengal and some other parts the natives live chiefly on rice, but millet is the staple food grain, barley, wheat, with sweet-potatoes, onions, and garlic, being also largely used. Opium is cultivated in Behar, Benares, and Malwa. The vast forests of India are tenanted by great numbers of wild animals, birds, and reptiles. Large herds of elephants are still met with in Nepaul, Eastern Bengal, and the Nilghiris; the bear, the wild boar, and rhinoceros chiefly in the woods of the Eastern Himalaya; the tiger is found in every part of the country; the lion is now almost extinct. Other carnivorous mammals are the leopard or panther, cheetah, wolf, fox, jackal, and hyæna. Several antelopes and deer, wild sheep and goats, the wild ass, the great gaur ox or ‘ bison ’, and the wild buffalo are among the fauna. Snakes and reptiles in all varieties are very numerous, and the cobra and other snakes cause numerous deaths. Amongst domestic animals are oxen, camels, horses, mules, sheep, and goats. Of birds, eagles, vultures, the peacock, parrakeets, and the adjutant-bird, are characteristic species. Fish are plentiful and in great variety.

Minerals.—India is richly endowed with minerals, including coal, iron, gold, copper, and antimony, with petroleum in Burmah. There is now an important output of coal (22,628,000 tons in 1919), gold, and petroleum, and salt is a valuable article of commerce.

Government, Administration, Divisions, and Population.—In 1858 the administration of the British possessions in India was transferred from the East India Company to the Crown, and in 1877 Queen Victoria assumed the title of Empress of India, Edward VII naturally succeeding her as Emperor. The form of government of the Indian Empire is established by various Parliamentary Statutes, now consolidated in the Government of India Act, 1915, amended by the Government of India Act, 1916, and the Government of India Act, 1919. In England the administration of the Indian Empire is entrusted to the Secretary of State for India, who is assisted by a Council of not less than eight and not more than twelve members, at least one-half of whom must be persons who have served or resided ten years in India. In 1919 Lord Sinha of Rajpur was appointed Under-Secretary of State for India, and was thus the first Indian to hold this office. In India the supreme executive authority is vested in the Governor-General in Council, who is appointed by the Crown. The Indian Legislature consists of the Governor-General and two Chambers, the Council of State and the Legislative Assembly, the former consisting of 60, and the latter of 140 members. This Legislature has power to make laws for all persons within the Indian territories under British rule, and for all subjects of the Crown within the allied native states. By the Government of India Act, 1919, important constitutional changes were effected in India, especially in the government of the Provinces. The provincial subjects were definitely committed to the Provincial Governments. These Provincial Governments now consist of an Executive Council and Legislative Council. The executive authority is vested in the Governor of the Province, who is assisted by a Council of four members. Ministers look after the various departments of State. All the large Provinces are each under a Governor, but Burmah is under a Lieutenant-Governor. Administrative changes took place in 1919, and as a result India is now divided into fifteen administrations, as follows: *Madras* (142,330 sq. miles, pop. 41,405,404); *Bombay* (123,059 sq. miles, pop. 19,672,642); *Bengal* (78,699 sq. miles, pop. 45,488,077); *United Provinces of Agra and Oudh* (107,267 sq. miles, pop. 47,182,044); *Punjab* (99,000 sq. miles, pop. 19,975,000); *Burmah* (230,890 sq. miles, pop. 12,116,000); *Bihar and Orissa* (83,180 sq. miles, pop. 34,500,000); *Central Provinces and Berar* (nearly 100,000 sq. miles, pop. 13,917,000); *Assam* (53,000 sq. miles, pop. 6,714,000); *North-West Frontier Province* (13,400 sq. miles, pop. 2,197,000); *Ajmer-Merwera* (2700 sq. miles, pop. 500,000); *Coorg* (1580 sq. miles, pop. 175,000); *Baluchistan* (54,230 sq. miles, pop. 415,000); *Delhi* (seat of government of India) (557 sq. miles, pop. 392,000); *Andaman and Nikobar Islands* (3140 sq. miles, pop. 26,450). There are also a number of native or feudatory states, the relations of which to British rule are somewhat varied. Their area is 709,555 sq. miles, and their population 70,888,854, the most important being Hyderabad, Kashmir, Mysore, Travancore, Baroda, Baluchistan States, Central India Agency, Bombay States, Madras States, and Bengal States. Total area of Indian Empire, 1,802,629 sq. miles; pop. 315,156,396.

Army.—The army in India consists of the British regular forces, the native army, and the imperial service troops. In 1914, before the outbreak of the European War, the regular forces in India numbered 210,000. See *Army*.



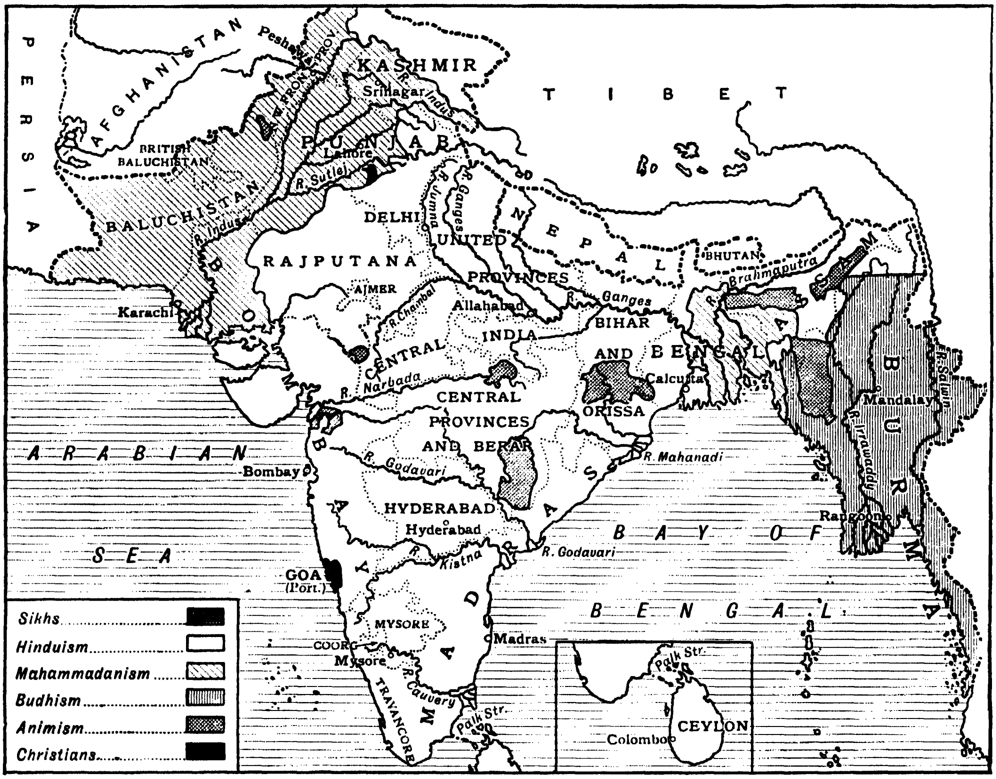
Revenue, Money, Weights, &c.—The total revenue, according to the Budget estimates of 1919 was £121,000,000, and the expenditure £125,754,000. The public debt is £456,294,269 (1920). The chief source of revenue is the land tax, which yielded £22,686,400 in 1919-20. In India the State or monarch has always enjoyed a share in the rent or profits from the land. Before the advent of the Mahommedans the village community was the unit for purposes of revenue collection, private ownership being unknown. With the Mahommedan conquest the State claimed one-third of the gross produce of the soil as its share, entrusting its collection to *zamindars*, or revenue farmers. Under British rule the aim has been to substitute private property in the soil for the older communal systems, and hence the zamindars, who were in no sense proprietors, have become so in several parts of British India, whilst in others, as in Madras and Bombay, the cultivating *rayats* (or *ryots*) have been raised to the status of peasant proprietors. The village community, however, in some form still exists both in British and native territory. The process of periodically fixing the land revenue demand is known as the 'Land Settlement'. About 70 per cent of the population are engaged in agriculture. Opium, which forms a Government monopoly, and salt, on which a considerable duty is levied, are other two important sources of revenue, besides the customs and excise. The opium revenue—which has considerably decreased—is raised partly by a monopoly in Bengal, and partly by the levy of a high duty on all opium exported from native states. The opium grower in the monopoly districts is required to deliver his produce to Government agents at a fixed price, and it is afterwards sold by auction before being exported. The chief money denomination is the *rupee*, which is divided into 16 *annas*, the anna again being equivalent to 4 *pice*. The ordinary currency is silver and copper, but gold is also legal tender. There are mints at Calcutta and Bombay. A Government paper currency was introduced in 1861. The primary standard of weight, called the *ser*, is equal to the kilogramme, or 2·205 lb. A weight in common use is the *maund*, in Bengal 82 lb., in Bombay 28 lb., in Madras 25 lb. The imperial yard is the standard measure of length.

Manufactures.—An important manufacturing industry has been growing up, largely taking the place of the domestic industries of India, which, however, are still to some extent practised after ancient methods all over the country. Steam-power factories are at work, among which those for spinning and weaving cotton, for spinning and weaving jute, for making paper, for husking and cleaning rice, and for sawing timber, are the most important. In 1918 the number of cotton-mills was 236, employing 261,176 persons, and of jute-mills 76, employing 266,038 persons. There are also woollen-mills, silk-mills, soap-factories, tanneries, iron- and brass-foundries, sugar-factories, breweries, oil-mills, flour-mills, ice-factories, pottery- and tile-factories, tobacco- and cigar-factories, glass-factories, dye-works, indigo-factories, and others.

Canals and Irrigation.—The necessity for irrigation in many extensive areas, owing to the insufficiency or uncertainty of the rainfall, has long been recognized in India, and many of the irrigation works now administered by the Public Works Department are old native works restored or extended. The total irrigated area of India is about 37 million acres, and the money expended on irrigation works in modern times has been about £30,000,000, irrigation and inland navigation being closely connected in many districts. Tank irrigation is very common in some districts, especially in Southern India, and the tanks are mostly of native origin. Another method, which prevails over large areas in all the provinces, is that by wells. Irrigation canals, all the most important of which have been constructed since the British occupation, are of two kinds, inundation and perennial. The latter are furnished with permanent head-works and weirs, and are capable of irrigating large areas throughout the year, independently of the local rainfall; whilst the former, which are peculiar to Sind and the Punjab, are simply earthen channels supplied with water by the annual rise in May of the Indus and its affluents. The total area irrigated by canals in 1918 was 21,338,000 acres. There are no large irrigation works in Burmah, but a considerable amount has been expended on river embankment and drainage works, and on making navigable channels.

Communications, Trade, &c.—Some of the irrigation canals as well as the rivers supply means of internal navigation, but the construction of railways has been the most important step taken to render the internal communications of India permanently efficient. A considerable portion of the railway system was constructed by companies on whose capital interest at the rate of 5 per cent was guaranteed by Government. Government, however, no longer entrusts the railways to private enterprise, and all lines sanctioned by it are now constructed by the State. The total railway mileage open for traffic in 1919 was 36,616 miles. There is an extensive system of posts and telegraphs, the length of telegraph lines in 1919 being 87,814 miles. The imports, including bullion and specie, for year ending March, 1920, amounted to £147,819,700, and the exports to £222,142,800. The chief imports are cotton woven goods and yarn, metals and hardware, oils (chiefly petroleum), sugar, railway material, machinery and mill-work, chemicals, medicines, dyes, woollen goods, silk (raw and manufactured), provisions, liquors, and apparel. The chief exports consist of jute (raw and woven), husked rice, hides and skins, oil-seeds, raw cotton, tea, opium, cotton yarns, wheat, indigo, coffee, raw wool, and cotton woven goods. The trade with Great Britain is over 50 per cent of the trade with Europe. Next to Britain, the chief countries trading with India are Japan, Java, United States, China, Ceylon, France, Italy, Persia, and Egypt. The trade across the land frontiers is steadily increasing, the chief item among imports being food grains, and among exports cotton goods.

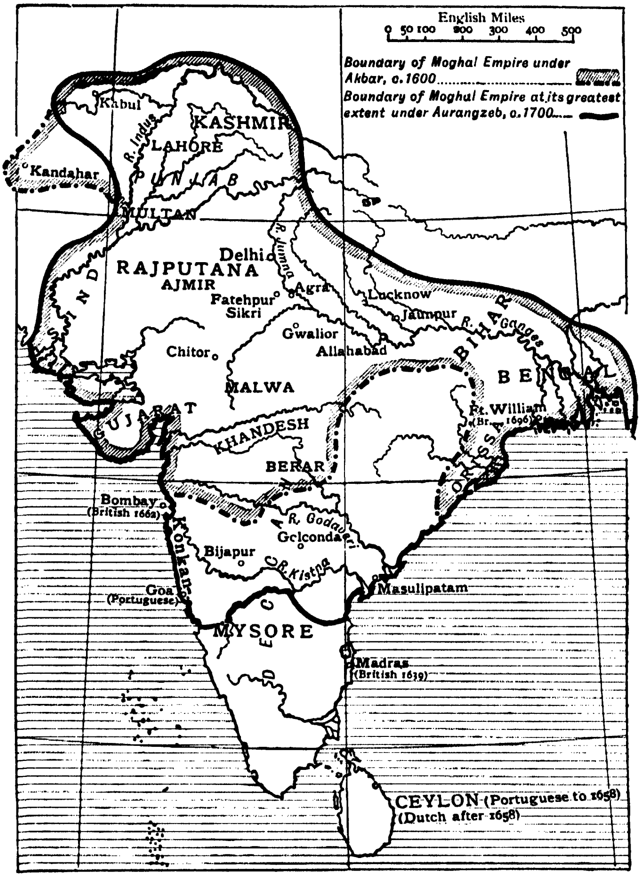
Inhabitants, Languages, &c.—India has been peopled by several races which have now become more or less mixed. The Hindus, who are partly of Aryan or Indo-European origin, partly of non-Aryan origin, but are Aryans by language, are by far the most numerous. In the south dwell people of a non-Aryan and Dravidian stock; and the remainder is made up of Burmese, Arabs, Parsees, Mongolians, &c. The Europeans number about 168,000, and in addition there are about 80,000 Eurasians, i.e. the progeny of Hindus and Europeans. The number of languages spoken in India totals 220. The Dravidian languages, the chief dialects of which are the Tamil, Telegu, Kanarese, and Malayalam, are spoken by about 87 millions of people in Southern India. The principal of the modern Aryan vernaculars derived from the ancient Sanskrit and Prakrit are Hindi, Marathi, Punjabi, Bengali, Uriya, Sindhi, and Gujerati. Hindustani, a corrupted form of Hindi filled with Persian and Arabic words, is the language of the Mahommedan conquerors of India, and has been adopted as the official language and means of general intercourse throughout the peninsula. The leading religion is Hinduism, the professed creed of the majority of the Hindus and the religion most distinctive of India. It reckoned 217,500,000 adherents in 1911. Large numbers in the north and north-west are Mahommedans (about 66,500,000). Buddhists number about 10,500,000; Parsees or Fire-worshippers 100,000; Sikhs 3,000,000. Among the Hindus the caste system still prevails. (See *Brahmanism.*) European missionaries have long been active, but only a mere fraction of the people are as yet Christians (3,750,000). Education is now making good progress, schools and colleges of all kinds having been established throughout the country. The pupils, however, only number about 7,311,742 (1918) in all. There are universities at Calcutta, Bombay, Madras, the Punjab, and Allahabad. A Hindu university has been established at Benares, and another at Patna.



India: Religions

History.—The early history of India is obscurely written in the myths of Sanskrit literature, but the first fact of any certainty is that about the year 2000 B.C., or even earlier, an Aryan people of comparatively high civilization descended from the mountain regions of the north-west into the plains of India and subdued the original inhabitants there. The expedition of Alexander the Great to the Indus in 326 B.C. gives us a momentary glimpse of that part of India; but between his invasion and the Mahommedan conquest there is little authentic political history of India. In the third century B.C. Buddhism was established throughout India, but it afterwards entirely gave way to Brahmanism. The first six centuries of the Christian era were occupied by struggles between the native dynasties and invaders from the north-west. In the eighth century the tide of Mahommedan conquest began with Kasim's advance into Sind (A.D. 711). But the Mahommedans were again driven out in 828, and for more than 150 years afterwards the strong feudal and tribal organizations of the northern Hindu kingdoms were a barrier to the Mussulman advance. At length in the year 1001

Mahmud of Ghazni reduced the Punjab to a province of Ghazni, and the Mahommedan power was gradually extended into Southern India. In 1398 Timur or Tamerlane led a great Mogul (or Mongol) invasion of India, and after sacking Delhi retired into Central Asia. In 1526 Sultan Baber, a descendant of Tamerlane, founded the Mogul Empire in India. His grandson Akbar reigned from 1556 to 1605, and extended his power over most of the peninsula, being distinguished by his justice and his tolerance in matters of religion. His son Jehanghir received an ambassador from James I in 1615. During the reign of his successor, Shah Jehan, famous for his architectural magnificence, the Mahrattas began to be formidable in Southern India. Shah Jehan was deposed in 1658 by his youngest son, Aurangzib, who made war successfully with the Afghans, the Rajputana tribes, and the rising power of the Mahrattas. The Sikhs, a Hindu sect, formed a religious and military commonwealth in the Punjab in 1675. On the death of Aurangzib in 1707 the Mogul Empire began to decline, Mahommedan viceroys like the Nizam and the ruler of Oudh asserting their independence, while the great Hindu states of the Sikhs, the Rajputs, and the Mahrattas began to harass the decaying empire. In 1738 Nadir Shah of Persia swept down on Hindustan, sacked Delhi, and carried away sixty millions sterling of treasure. The two immediate successors of Aurangzib, Bahadur Shah and Jahandar Shah, were incapable rulers, practically under the control of the vizier Zulfikar Khan. The three following were mere names under cover of which Husain Ali, Governor of Behar, and Abdulla, Governor of Allahabad, controlled affairs. During the reign of Mahommed Shah the Mahrattas, who had already subdued the Deccan, wrung first Malwa (1743) then Orissa (1751) from the feeble grasp of the Mogul emperor. The same year saw the first inroad of the Afghan prince Ahmed Shah, followed in quick succession by three other invasions, to repel which the assistance of the Mahrattas was obtained. In 1761 the decisive battle of Panipat was fought between the Afghans and the Mahrattas, and ended in the defeat of the latter. The victor, Ahmed Shah, still recognized the Emperor Shah Alam, but the dignity was little more than nominal. Shah Alam was succeeded in 1806 by Akbar II, who was succeeded in turn by Mahommed Bahadur Shah, the last Mogul emperor, who died at Rangoon a British State prisoner in 1862.



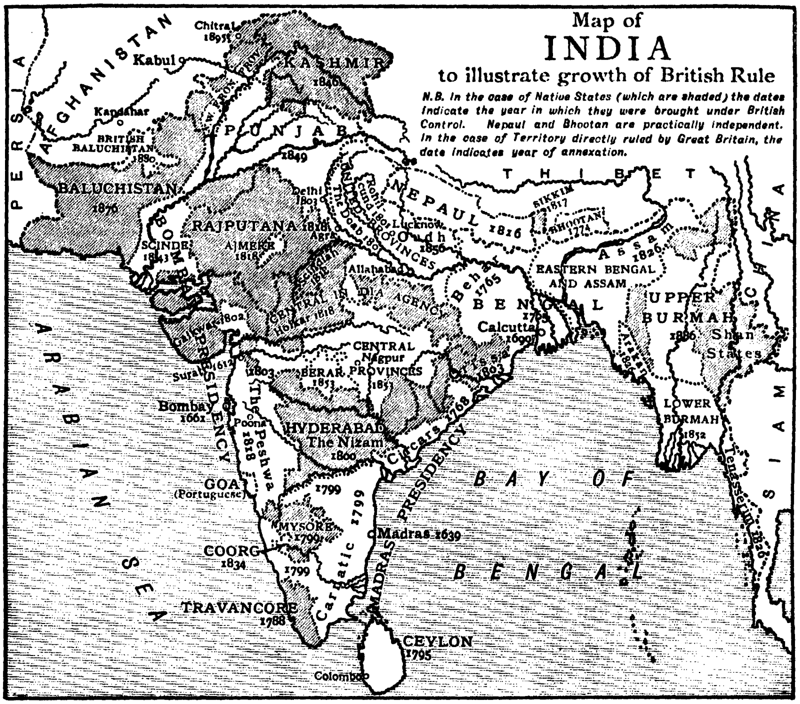
India under the Great Moguls

In the beginning of the sixteenth century the Portuguese, following in the wake of Vasco da Gama, had established factories and fortresses on the coasts of Malabar, and soon extended their power over nearly all the ports and islands on the coasts of Persia and India. In 1595 the Dutch gained a footing in India. The English East India Company had formed commercial settlements in India as early as 1613, Surat being the chief station. (See *East India Company.*) A grant of a small territory around Madras was received from the Rajah of Bijnagar in 1639, on which was erected the fort of St.

George. Madras became a presidency in 1654. Calcutta, ultimately the seat of government in India, was settled in 1690, and became a presidency in 1707. The English early came into collision with the Portuguese and Dutch, but it was the struggle with the French in India, (their first settlements were founded in 1604), for influence over the native princes, that led step by step to the establishment of the British Empire in India. The first conflict with the French took place in 1746, when the English lost Madras, which was, however, restored by the treaty of Aix-la-Chapelle. In 1751 Dupleix, the French Governor of Pondicherry, was powerful enough to place creatures of his own on the thrones of the Deccan and the Carnatic. The English supported rival candidates, and the result was a second war, which left English influence predominant in the Carnatic, though the French still controlled the Deccan. The most memorable incident in this war was Clive's capture of Arcot. About this time important events took place in Bengal, then a subordinate presidency to that of Madras. The Nawab of Bengal, Siráj-ud-Daulá (Surajah Dowlah), attacked the English settlement at Calcutta with a large army, forced it to capitulate, and thrust the prisoners, to the number of 146, into the Black Hole or common prison of the garrison, a room 18 feet square, with two small windows. After a night of unparalleled suffering only twenty-three were found alive in the morning. Clive was at once sent with an armed force from Madras, recovered Calcútta, attacked and took the French settlement at Chandernagore, routed the Nawab's army at the battle of Plassey (23rd June, 1757), and placed Mir Jaffier on the vice-regal throne, with consent of the Mogul court. In the south the English were equally victorious. A force dispatched by Clive took Masulipatam, and the victory gained by Coote at Wandewash on 22nd Jan., 1760, completed the destruction of the French power in India.

In Bengal Mir Jaffier soon found himself unable to meet the exorbitant claims of his allies, and in 1760 he was deposed in favour of his son-in-law, Mir Kasim, who agreed to pay the balance due by Mir Jaffier as well as grant the districts of Burdwan, Midnapore, and Chittagong to the English. But disputes soon led to a war, in which Mir Kasim was worsted and forced to flee. The British retained the collectorship or fiscal administration of Bengal, Behar, and Orissa, under the fiction of a grant from the Mogul emperor. A nominal native ruler, however, was still appointed in the shape of a nawab, who received an allowance of £600,000, and the actual collection of the revenues was still left to the native officials. This system of double government established by Clive was abolished in 1772 by Warren Hastings, who appointed English officers to collect the revenues and preside in the courts, and thus laid the foundations of the present system of British administration in India. In 1774 Hastings was made Governor-General of India. Amongst the notable measures of his vigorous rule were the refusal of the £300,000 of the Bengal tribute to the Mogul emperor, the sale of the provinces of Allahabad and Kora (assigned by Clive to the emperor in 1765) to the Nawab of Oudh, and the loan of British troops to the same nawab for the subjection of the Rohilla Afghans. For these and other acts, such as the extortion of heavy fines and forfeitures from the Begum of Oudh and the Rajah of Benares, Hastings was impeached on his return to England. (See *Hastings.*) In 1778 the intrigues of the Bombay Government led to the first war with the Mahrattas, in which the British arms were only saved from disgrace by the achievements of the Bengal army which Hastings sent to the aid of the other presidency; and in the war with the Sultan of Mysore the diplomatic skill of Hastings, and the valour of the Bengal troops under Sir Eyre Coote, again won victory for the British. In 1786 Lord Cornwallis succeeded Hastings as Governor. His rule is memorable chiefly for the war with Tippoo, Sultan of Mysore, which terminated in the Sultan having to surrender one-half of his dominions to the British and their allies. Sir John Shore succeeded as Governor-General in 1793. He was followed by the Marquess Wellesley, who arrived in 1798, and whose policy eventually made the British power paramount from the Himálaya to Cape Comorin. Under him Tippoo of Mysore was completely overthrown (1799) and the second Mahratta war successfully concluded, Arthur Wellesley (afterwards Duke of Wellington) having won the victory of Assaye (23rd Sept., 1803), and General Lake that of Laswaree (1st Nov., 1803). In 1805 Lord Cornwallis went out as Governor-General for the second time. He died soon after his arrival, and was succeeded by Sir George Barlow, and he by Lord Minto in 1807. In 1809 some disturbances at Travancore and Cochin led to these regions being placed under British control. During the governorship of the Earl of Moira (Marquess of Hastings, 1814–23) there was a war with the Goorkhas of Nepaul, which after a short struggle ended with the cession to the British of Kumáon; and another with the three great Mahratta princes, the Peshwá of Poona, the Rajah of Nágpur, and Holkar of Indore. The Peshwá's territory was annexed; the other Mahratta princes were compelled to accept alliances placing them under British protection. A new province, the

nucleus of what are now the Central Provinces, was formed out of territory recovered from the Pindáris. In 1823 Lord Amherst succeeded as Governor-General. During his administration the first Burmese War arose, and was concluded in 1826 by the cession to the British of the provinces of Aracan and Tenasserim. Under Lord William Bentinck's rule (1828–35) administrative reform and the moral elevation of the peoples of India were chief subjects of consideration. In 1836 Lord Auckland assumed the governorship. Two years later the Afghan War broke out, and terminated in the disastrous British retreat. (See *Afghanistan.*) During Lord Ellenborough's administration Sind was annexed. Sir Henry (afterwards Lord) Hardinge succeeded in 1844, and the year following the Sikhs, originally a religious sect who had conquered the Punjab, crossed the Sutlej in great force. Four hotly-contested battles, at Mudki, Firozshah, Aliwál, and Sobráon, left the British masters of the field. Part of the Sikh territory was annexed, and the infant Dhuleep Singh recognized as rajah of the rest. In the governor-generalship of the Marquess of Dalhousie (1848–56), a new war broke out with the Sikhs, and after their final defeat by General Gough at Gujerat, 21st Feb., 1849, the Punjab was annexed to the British dominions. This was immediately followed by the second Burmese War, ending in the annexation of Pegu, 20th June, 1853. The Indian states of Sattara, Jhansi, and Nágpur were, on the failure of the native succession, annexed to the British possessions (1852–6), and Oudh also brought directly under British rule. During the same administration the extensive scheme of Indian railways and telegraphs and steamship connection with Europe via the Red Sea was planned and inaugurated, the Ganges Canal opened, and the Punjab Canal begun.



Map of
INDIA
to illustrate growth of British Rule

N.B. In the case of Native States (which are shaded) the dates indicate the year in which they were brought under British Control. Nepaul and Bhootan are practically independent. In the case of Territory directly ruled by Great Britain, the date indicates year of annexation.

The administration of Viscount Canning (1856–61) was distinguished by a short war with Persia, and especially by the great sepoy mutiny. Several outbreaks among the native soldiers took place during March, 1857. The first formidable revolt, however, was at Meerut on 10th May, where the sepoys of the 3rd Light Cavalry, assisted by the 11th and 20th Regiments of infantry, rose and massacred the Europeans. They then fled to Delhi, where they were immediately joined by the native garrison. Here another massacre took place, and the dethroned descendant of the Moguls once more assumed the sovereignty. The revolt spread rapidly through the North-Western Provinces and Oudh, down into Lower Bengal. Only in the Punjab the prompt measures of the governing officials in disarming the sepoys prevented an outbreak, and the Sikh population continued steadily loyal. Wherever the mutiny broke out it was attended with savage excesses; women were outraged, and Europeans without distinction of age or sex barbarously murdered. At Cawnpore the revolted sepoys were headed by Nana Sahib, the heir of the last Peshwá of the Mahrattas. After a heroic but fruitless attempt to defend themselves, the Europeans capitulated on the sworn promise of Nana Sahib to allow them to retire to Allahabad. On the 27th the survivors, about 450 in number, were embarking when they were attacked by the Nana's troops, and the men indiscriminately massacred. The women and children, 125 in number, were carried back to Cawnpore and kept till the 15th of July, when they were all cut to pieces on the approach of Havelock's army. Cawnpore was stormed the day following. At Lucknow Sir Henry Lawrence had the foresight to fortify and provision the Residency, where the garrison held out till relieved by Havelock and Outram on 25th Sept. But Havelock was in turn besieged, and was with difficulty relieved (17th Nov.) by Sir Colin Campbell, afterwards Lord Clyde. Delhi, meanwhile, had fallen, chiefly owing to the skill and valour of Sir John Lawrence. By May, 1858, when Bareilly was taken, Sir Colin Campbell and Sir Hugh Rose had restored order, and the mutiny was at an end.

In 1858 the direct sovereignty of India, and the powers of government hitherto vested in the East India Company, were vested in the British Crown. Lord Canning returned to England early in 1862, and was succeeded by the Earl of Elgin, who died in 1863. Sir John (afterwards Lord) Lawrence was Governor-General from 1863 to 1868, when he was succeeded by the Earl of Mayo, who did much to develop the material resources of the country by removing the restrictions upon trade between the different provinces, and constructing roads, canals, and railways. He was assassinated by a Mahommedan fanatic in the Andaman Islands, and Lord Northbrook became Viceroy in 1872. During his administration a famine in Lower Bengal (1874), the dethronement of the Gaekwár of Baroda for disloyalty (1875), and the tour of the Prince of Wales through India (1875–6) were the chief events. In 1876 Lord Lytton was appointed Viceroy, and on 1st Jan., 1877, Queen Victoria was proclaimed Empress of India at Delhi. In 1877–8 a serious famine again occurred, and there have been others since, as well as visitations of plague (1896–9). In 1880 Lord Ripon became Viceroy, being followed in 1884 by Lord Dufferin, under whom Upper Burmah was annexed, 1st Jan., 1886. He was followed by the Marquess of Lansdowne, the Earl of Elgin, and Marquess Curzon. Under him were formed the North-West Frontier Province and that of Eastern Bengal and Assam, and the expedition into Tibet took place. In the winter of 1905–6 India was visited by the Prince and Princess of Wales. In 1905 the Earl of Minto became Viceroy, and during his administration discontent in India increased. The Government, while putting down sedition, introduced various reforms. Native Hindus were appointed to the Council of the Secretary of State and to the Council of the Viceroy, and the Indian legislative councils were reorganized. Lord Minto was succeeded in 1910 by Lord Hardinge of Penshurst. In 1911 King George V visited India, and at an assembly at Delhi announced his coronation. Delhi became the capital instead of Calcutta, a redistribution of boundaries took place, and Benares was erected into a feudatory state. When the European War broke out, India generously and enthusiastically supported Great Britain with troops and money, and an expedition from India went to Mesopotamia. Even loyal Indians, however, were of opinion that in view of India's loyalty and ungrudging support the country deserved a better treatment and should no longer be considered as a mere dependency. Extremists, on the other hand, were stirring up hatred and revolution, and clamoured for absolute independence and self-government. Lord Chelmsford succeeded Lord Hardinge as Viceroy in 1916, and the Secretary of State for India visited the country in 1917. In 1919 the Government of India Act was passed, and the existing system of administration was introduced. In the meantime, however, the seditious troubles continued, and the extremists were busy stirring up Mahommedan feeling over the break-up of Turkey. In April, 1919, disturbances broke out in Ahmadabad and the Punjab, and although they were rigorously put down, dissatisfaction continued. The Ameer of Afghanistan tried to invade India in May, 1919, but his armies were defeated. In 1921 the Earl of Reading was appointed Viceroy, and left for India in March. During the winter 1921–2 the Prince of Wales visited India. — BIBLIOGRAPHY: Sir W. W. Hunter, *Brief History of the Indian Peoples*; Sir W. Lee-Warner, *The Protected Princes of India*; A. D. Innes, *A Short History of the British in India*; S. Lane-Poole, *Mediæval India*; M. Elphinstone, *History of India*; Sir T. W. Holderness, *Peoples and Problems of India*; V. A. Smith, *The Oxford History of India from Earliest Times to 1911*; L. J. Trotter and W. H. Hutton, *History of India*; J. R. Macdonald, *The Government of India*.

India, Orders of Knighthood in, consist of *The Most Exalted Order of the Star of India,* instituted in 1861, and comprising the Viceroy of India as Grand Master, and a number of Knights Grand Commanders (G.C.S.I.), Knights Commanders (K.C.S.I.), and Companions (C.S.I.); *The Most Eminent Order of the Indian Empire,* instituted 1st Jan., 1878, and comprising the Viceroy of India as Grand Master, a number of Knights Grand Commanders (G.C.I.E.), Knights Commanders (K.C.I.E.), and Companions (C.I.E.). The constitution of this Order was revised in 1911. *The Imperial Order of the Crown of India* was instituted 1st Jan., 1878, its members comprising the Princess of Wales and the princesses of the blood-royal, and other British and Indian ladies.

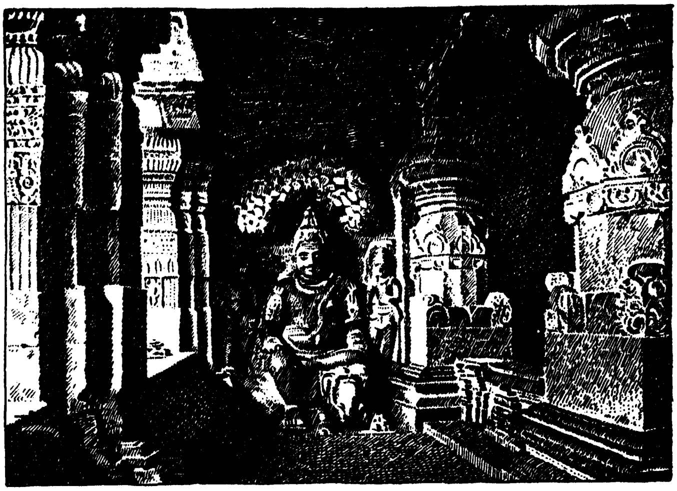
Insignia of the Order of the Star of India

India Matting, a matting woven from the stems of *Papyrus Pangorei* or *corymbosus,* and chiefly exported from Bengal. Variety is obtained by colouring-matters either on the stems themselves or as a pattern printed on the surface of the mat.

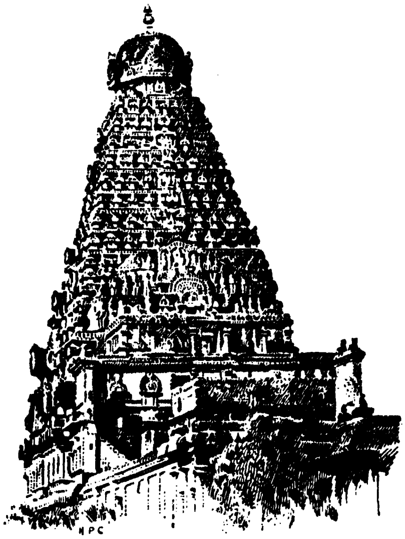
Indian'a, one of the United States, bounded by Michigan lake and state, Ohio, Kentucky, and Illinois. It is almost one continuous plain, with the exception of the hills of the Ohio River and Wabash valleys, which rise from 200 to 600 feet above the sea-level. The western side of the state, north of the Wabash, is mostly prairie-land interspersed with lakes, woodlands, and swamps. The eastern part was originally thickly covered with forests, which, however, are rapidly disappearing before the settler. Indian corn, wheat, oats, barley, tobacco, and potatoes are the chief agricultural products. Molasses, cider, wine, honey, cheese, and milk are also plentifully produced. Immense herds of cattle and swine are reared. The coal-fields of the state have an area of 6500 sq. miles, with coal of excellent quality, and an output which amounts to over 17,000,000 short tons. Woollens, cottons, lumber, agricultural implements, manufactures of iron, paper, and leather are leading industries. The Ohio, White River, Wabash, and the Miami are the principal rivers. A canal 467 miles in length, from Evansville to Toledo, unites the Ohio, the Wabash, and Lake Erie. There are 7475 miles of steam railway, and 2468 miles of electric railway. The principal towns are Indianapolis (the capital), Evansville, Fort Wayne, Terre-Haute, New Albany, Lafayette, South Bend, Madison, &c. Indiana was part of the territory ceded by the French to the British in 1763, and by the British to the United States in 1783. It was erected into a state in 1816. Pop. in 1910, 2,700,876; 1920, 2,930,390.

Indianap'olis, a city of the United States, capital of Indiana, on the White River, near the centre of the state, mostly situated on a plain. It is the centre of numerous railroads, and, being surrounded by rich agricultural and mineral regions, is a place of great trade and manufactures. It is an important market for grain, live stock, and timber, and carries on pork-packing, the production of iron goods of various kinds, agricultural implements, woollens, and flour. The city is built in the usual transatlantic style, the chief building being the state house. Educational and benevolent institutions are numerous, the former including a university, medical and other colleges. Pop. 314,194.

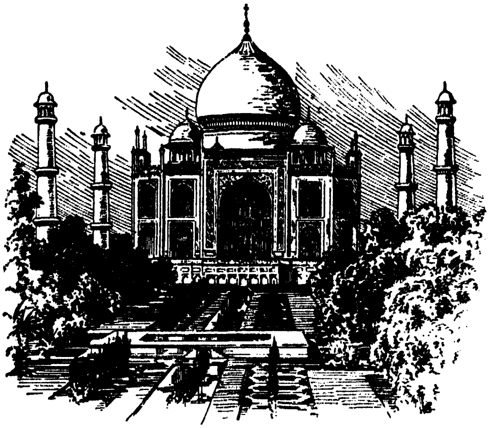
Indian Architecture comprehends a great variety of styles, among which we may distinguish, as the most important, the Buddhist style, the Jaina style, the Dravidian or style of Southern India, the Chalukyan style, and the Modern Hindu or Indian-Saracenic style. The history of Indian architecture commences in the third century B.C. with the religious buildings and monuments of the Buddhists. Amongst the principal forms of *Buddhist architecture* are the following: First, the *topes, stupas,* or towers built to mark some sacred spot, and the *dagobas,* constructions of a similar nature, containing relics of Buddha or Buddhist saints. These buildings generally consisted of a circular stone basement, varying from 10 or 12 to 40 feet in height, and from 40 to 120 feet in diameter, on which rose a rounded domical structure, generally of brick or small stones laid in mud, the whole edifice rising sometimes 50, sometimes 100 feet high. (See *Dagoba; Tope.*) Second, the rock-cut *chaitya halls* or churches, and the *viharas* or monasteries. Most of these are found in the Bombay Presidency; some also in Bengal and Behar. In rock-cut buildings architectural skill is confined to the façade and the interior, which are generally cut out with most beautiful and perfect detail. Amongst the most notable for beauty of design are those at Ajanta, and, finest and largest of all, the great Chaitya cave at Karli, near Bombay, the date of which is probably about 80 B.C. Another interesting example is at Ellora. The *Jaina style* is a development or corruption of the pure Buddhist. It is characterized by the square or polygonal court, the twelve-pillared dome, the slenderness and elegance of the columns, the horizontal arch, the *sikras* or towers surmounting the cells containing the images, and, lastly, by the peculiar grouping of many temples together on hill-tops. Prominent examples of Jaina architecture are found at Girnar in Gujerat; and at Mount Abu, of the Aravulli range. The *Dravidian style* is that of the peoples of Southern India. Its most flourishing epoch comprises the sixteenth, seventeenth, and even eighteenth centuries of our era. To this late period belong the great temples at Tanjore and Tiruvalur. The distinctive parts of a Dravidian temple are the *vimana* or temple proper, with storied pyramidal roof; the *mantapas* or porches, covering the door which leads to the cell; the *gopuras* or gate-pyramids, in the quadrangular enclosures surrounding the vimanas; the *choultries* or pillared halls, used for various purposes. The general characteristics of a Dravidian temple of the first class are the storied pyramidal towers, the hall of 1000 columns, the bold cornice with double flexure, the detached shafts, the richly-carved stylobate, and the large tanks with flights of stone steps. The *Chalukyan style*, so named from a dynasty which rose in the sixth century, in what is now Mysore and the Nizam's Territory, reached its perfection in Mysore from the eleventh to fourteenth centuries. The characteristic features are the open porch, the straight-lined, conical-shaped tower, the star-shaped temple, and the basement terrace of stone. The *Indian-Saracenic style* is a general name for a number of somewhat varying styles, the result of the mixture of Saracenic principles of architecture, brought with them by the Mahommedan conquerors of India, and the distinctive architectural features of the different localities where they settled. Under the Mogul emperors in the sixteenth century some most magnificent buildings were erected, such as the tomb of Humayun Shah at Old Delhi; that of Akbar at Secundra (see *Akbar*); the palaces of Shah Jehan at Agra and Delhi; and the Taj Mahal, built by the same monarch at Agra. The Moslem architecture of India contrasts with the native Indian styles in its use of the radiating arch, in the superior simplicity and grandeur of its style—its flat ornamentation not interfering with the lines of true architectural construction. A characteristic feature also is its fine conventionalism of vegetable forms for decoration and tracery. See *Saracenic Archi-*



Rock-cut Temple at Ellora—Buddhist Style



Shrine over the great Temple at Tanjore—Dravidian Style *tecture*.—Bibliography: J. Fergusson, *History of Indian and Eastern Architecture*; G. Le Bon, *Les Monuments de l'Inde*; E. B. Havell, *Handbook of Indian Art*; *Ideals of Indian Art*.



The Taj Mahal, Agra

Indian Civil Service. The Indian Civil Service offers a magnificent opportunity to any man who is not afraid of responsibility and who possesses initiative. It is a service with great traditions, and though recent changes of policy in the government of India may seem to have imperilled these traditions, it is none the less certain that, more than ever, Britain will require in India the type of man who, in respect both of character and intellect, will maintain those principles of equity and wise moderation in government for which Indian civil servants have long been renowned.

It is now the policy to employ a considerably larger proportion of Indians in the service than was formerly the case. Competition among European candidates, therefore, will be more severe. Candidates must satisfy the Civil Service Commissioners that they are British subjects, that they are in good health, and of good moral character. The competition for places is held annually on 1st Aug. and following days of each year. The necessary forms of application must be in the hands of the Commissioners by the third week of June in each year. At present (1922) the age limits are twenty-one to twenty-four. By 1924 the age limits will be twenty-one to twenty-three.

The examinations, for which a fee of £8 is charged, are held in London. They aim at discovering in the candidate not merely specialized knowledge along one line of study, but the standard of his general culture. All candidates are required to take an English essay, general questions in the use of English, papers on contemporary subjects, social, economic, and political. A paper is set on matters relating to the general principles and methods of service, and candidates are required to translate from a modern language, or, in special cases, from Latin. In this part of the examination there is a viva-voce test, which carries no fewer than 300 marks out of the 800 which forms the maximum for this part of the examination. In the second part of the examination, which carries a maximum of 1000 marks, candidates are given a very wide choice. Here intensive study of languages, or history, or economics, or mathematics and science is essential. No one need attempt the examination whose standard of knowledge is not equivalent to that demanded for the Honours Degrees of British universities.

The successful candidate, before proceeding to India, undergoes a two-years' probation in this country, generally at the Universities of Oxford or Cambridge. During this period he is paid an annual sum by the Government, amply sufficient to maintain him in residence. At the end of that period he must pass a final examination in one Indian language, together with tests on the Indian Penal Code, Code of Criminal Procedure, the Indian Evidence Act, and Indian history. He must also pass a riding test.

The pay of an Indian civil servant begins at 600 rupees a month. By the eleventh year of service he has risen to 1600 rupees per month, and at this point he must pass an 'efficiency' test. At the twenty-fifth year of service the pay is 2500 rupees a month, when the civil servant is eligible to retire on a pension of £1000 per annum. A deduction of 4 per cent of salary made throughout his service is separately funded and returned to him on his retirement, or paid to his heirs in case of death.

The pecuniary advantages are very considerable. But they are of small account when compared with the powers and responsibilities given by such an appointment; and nowhere in the world can one find a field so rich as India in opportunities for administrative ability and genuine leadership.

Indian Fig, a name given to the *Opuntia Tuna* and *O. ficus-indica*, and other species of the Cactus family common in the tropical and sub-tropical countries of America, and now naturalized in Africa, Asia, and Southern Europe. They are generally from 10 to 12 feet high. Their fruit, which is egg-shaped and from 2 to 3 inches long, is cooling and wholesome, and yields a juice used for colouring confectionery. The wood of the stems becomes very hard with age.

Indian Ink. See *Inks*.

Indian Mutiny. See *India* (*History*).

Indian Ocean, that great body of water which has Asia on the north, the Sunda Isles and Australia on the east, Africa on the west, and the Antarctic Ocean on the south. The Cape of Good Hope and the southern extremity of Tasmania may be considered its extreme southern limits on the west and east. Its length from north to south somewhat exceeds 6500 miles; its breadth varies from 4000 to 6000 miles. It is traversed by the equatorial current flowing east to west, and its navigation by sailing vessels is more or less modified by the periodic trade-winds and monsoons. Its greatest known depth is 3393 fathoms. Its chief arms are the Bay of Bengal on the east of India, and the Arabian Sea on the west, extensions of the latter being the Persian Gulf and Red Sea. Madagascar, Ceylon, and Mauritius are among the islands.

Indians, American, the collective name given to the tribes inhabiting the continent at the time of the discovery by Columbus, and to such of their descendants as still survive. The name of Indians was first given to these races from the notion that the newly-discovered continent formed part of India. The Esquimaux or Innuit, the most northerly of the American tribes, are not usually classed among the Indians. Next below them are the allied Kenai and Athabascan groups, the former represented chiefly by the Yellow Knife or Atna tribe on the Yukon River. The Athabascans are chiefly found between Hudson Bay and the Rocky Mountains, but include besides the Chippeways, Coppermine, Dogrib, and Beaver Indians; the Tlatskanai, Unkwa, and Hoopah Indians of the Oregon coast; the Navaho tribe of the Highlands of New Mexico; the Apaches, ranging from the western Colorado to Chihuahua and Coahuila; and the Lipani, north of the mouth of the Rio Grande del Norte. Canada and the United States east of the Mississippi were formerly inhabited by the Algonquin-Lenappe and the Iroquois, generally at war with each other. The extreme west of the Algonquin region was occupied by the Blackfeet Indians; the Ojibeways held the shores of Lake Superior; south and west of Hudson Bay were the Crees. The Leni-Lenappe section of the Algonquin-Lenappe group comprised the five nations of the Delawares, including the Mohicans. The Iroquois included the Senecas, Cayugas, Onondagas, Oneidas, and Mohawks, who formed a league of five nations, afterwards joined by the Tuscaroras. The Hurons were of the Iroquois group. The Dacotah or Sioux group occupied the plains between the Rocky Mountains and the Mississippi as far south as Arkansas, and included the Assiniboias, Winnipegs, Iowas, Omahas, Osages, Kansas, Arkansas, Menitarees, Crows, and Mandans. West of the Mississippi also were the Pawnees and Riccaras about the Nebraska or Platte River, and to the south-east were the Choctaws and Chickasaws. In the Rocky Mountain regions were the Shoshone or Snake Indians, including the Comanches and others. The Cherokee tribes, which inhabited South and North Carolina, formed a detached group, and the Texas Indians were comprised in many small and diverse tribes. Below these, in New Mexico, a more advanced and distinct family is found called Moquis or Pueblo Indians. Of the numerous families occupying Mexico the Nahuatls or Aztecs were the most powerful and the inheritors of the high civilization of the Mayas. The Otomis, speaking a peculiar language, were also a numerous people in Mexico. In Central America the predominating family was the Maya, including the Quichés and Kachiquels. The ancient Maya people were the most highly civilized in Central America, probably because about twenty centuries ago the germs of the ancient civilization of South-Eastern Asia were planted in Honduras and the neighbourhood. Portions of the Aztec tribes were also found in Central America. In South America the leading and more advanced families were those that made up the Peruvian Empire, among which the Inca race and the Aymaras were the chief. The Araucanians, to the south of these, in Chile, had a considerable resemblance to the Algonquins and Iroquois of North America. The remaining portions of the continent, including the great alluvial tracts of the Atlantic slope, were principally occupied by the Guaranis; but along its northern coast were found the Caribs, who spread also over the Antilles and most of the West Indian Islands. In the extreme southern part of the continent live the tall Patagonians or Tchuelches, and squalid families in some respects resembling the more debased Australians.

The American Indians were originally derived from a protomongolian stock in North-Eastern Asia, which made its way into America by Behring's Strait. Before they left Asia these people had already become mingled with other Asiatic races; and for many centuries afterwards (and especially between 300 B.C. and A.D. 700) there were repeated accessions of small groups of aliens from the eastern shores of Asia and Polynesia to the Pacific littoral of America, and especially to Central America and Peru. They are generally characterized as having long, black, and straight hair, scanty beard, heavy brows, receding forehead, dull and sleepy eyes, a salient and dilated nose, full and compressed lips, and the face broad across the cheeks, which are prominent, but less angular than in the Mongolian. The facial angle is about 75° (about 5° less than the European average); the hands and feet are small and well proportioned. The complexion varies from dark-brown to almost white; a somewhat reddish tint is common. The North American Indian is described as of haughty demeanour, taciturn and stoical; cunning, brave, and often ferocious in war; his temperament poetic and imaginative, and his simple eloquence of great dignity and beauty. The Aztecs in Mexico worshipped the sun with human sacrifices and the grossest rites. The peoples of the United States and Canada believe in the two antagonistic principles of good and evil, and have a general belief in manitous, or spiritual beings, one of them being spoken of as the *Gitche Manitou*, or Great Spirit. They believe in the transmigration of the soul into other men and into animals, and in demons, witchcraft, and magic. They believe in life after death, where the spirit is surrounded with the pleasures of the ' happy hunting-grounds ', though they have no idea that the acts of their present life can have any connection with their future happiness. They adopt a *totem* or symbol of the name of the progenitor of the family; this is generally some animal (the turtle, bear, and wolf being favourites), which is the mark of families even when expanded into tribes. (See *Totemism.*) No marriage rite is necessary beyond the consent of the parties and their parents; but the wife may be dismissed for trifling causes, and polygamy is allowed. In ancient times the body was covered with furs and skins according to the seasons, but now the white man's clothes and blanket have generally superseded the native dress; though the moccasin of deer or moose hide, and in the wilder tribes the ornamental leggings and head-dresses, are largely retained. Their dwellings are made of bark, skins, and mattings of their own making, stretched on poles fixed in the ground. Their arms consist of the bow and arrow, the spear, tomahawk, and club, to which have been added the gun and knife of the whites. Canoes are made of logs hollowed out, or of birch bark stretched over a light frame, skilfully fastened with deer's sinews, and rendered water-tight by pitch. The antiquities found in Mexico and Peru, and the ruins of elaborate buildings in Central America, prove that the semi-civilized races there existing had adopted from the Old World (*c.* A.D. 300) high ideals of sculpture and architecture, but these arts, like the rest of their borrowed culture, rapidly deteriorated, and twelve centuries later, when the Spaniards arrived, their civilization was approaching its dissolution. The number of Indians in the British possessions is about 110,000, in the United States about 334,000, in Central America 1,500,000, and in Mexico 4,000,000, in all North America somewhere about 6,000,000. In South America their number is probably about 10,000,000, many of them being more or less civilized and professing Christianity. In this article it has not been possible to indicate the wide range of variations in physical type and in the customs and beliefs of the different groups of Indians. For such information see Clark Wissler, *The American Indian.*

Indian Territory, a tract of country in the United States allotted for the residence of certain of the Indian tribes who were partly removed from the south-east states of the Union. It was bounded mainly by Kansas, Texas, Oklahoma, and Arkansas, the southern boundary being formed by the Red River; area, 31,400 sq. miles. The chief rivers are the Arkansas and its tributaries (Canadian River, Neosho, &c.) and the Red River and its tributaries. The greater portion is fertile, and suited for stock-rearing. The Indian tribes or ' nations ' among which this territory was apportioned were the Cherokees, Creeks, Seminoles, Choctaws, and Chickasaws, all of whom have made considerable advances in civilization, having schools, churches, newspapers, &c. The white inhabitants have immensely increased since the opening of coal-mines, the construction of railways, &c. Cultivation is rapidly extending. The Indian Territory was reduced to about half in 1889 and subsequently, by the loss of Oklahoma, but on 16th June, 1906, a Bill was passed by which it was again united with Oklahoma (an area of 39,000 sq. miles) to form a state so called, the population having immensely increased. The population of Oklahoma state in 1920 was 2,028,283, including 119,101 Indians.

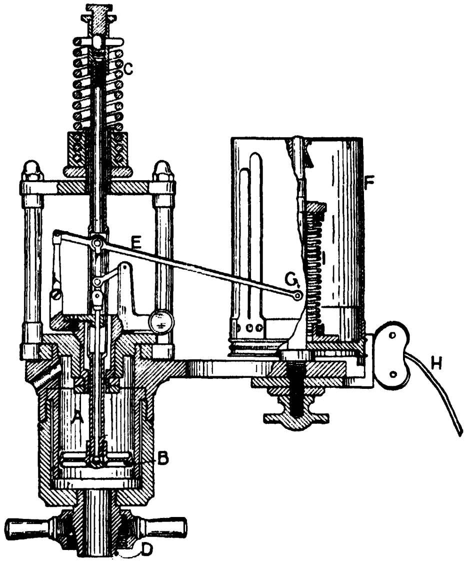
Indian Yellow, or **Purree,** a pigment used in India for colouring wood-work and by artists for water-colour. It has a disagreeable odour, and the colour is not permanent, and therefore not much used as a dye. Analysis shows the chief organic ingredient to be euxanthic acid ($C_{19}H_{18}O_{11}$), along with silicates of alumina, lime, and magnesia, water, and volatile matter.

India Office, an important Government department created in 1858, when, largely as a result of the disastrous Indian Mutiny, which took place in the previous year, the control of British India passed from the hands of the East India Company to those of the Crown. Since that date the direct government of India has been vested in a resident Viceroy and Governor-General, an office which Lord Canning was the first to hold. The Viceroy, appointed for five years, is assisted by an Executive Council composed of six ordinary members appointed by the Crown, with the addition of an extraordinary member in the person of the commander-in-chief of the army in India. This Executive Council has the functions of a Cabinet, and its members also sit as part of a Legislative Council, other members of which (from six to twelve in number) are appointed by the Viceroy. This high official is, in his turn, answerable to the Secretary of State for India, who, always a member of the British Cabinet, is at the head of the India Office. He is assisted by a Council the members of which vary in number from ten to fifteen; by permanent, parliamentary, and other under-secretaries; by an accountant-general, a Government director of Indian railway companies, and an extensive departmental staff. In 1920 was created, in accordance with an Act passed in the previous year, the new office of High Commissioner for India. Subject to the direction and control of the Governor-General in Council, the duties of the High Commissioner are to act as Agent in the United Kingdom on behalf of Local Governments in India for such persons as the Governor-General in Council shall prescribe; and, further, to conduct any business relating to the Government of India which, hitherto conducted by the India Office, may be assigned to him by the Secretary of State. The India Office is at Whitehall, London, S.W. The Secretaryship of State for India, with a salary of £5000 a year, has been held since 1917 by the Right Hon. Edwin Samuel Montagu, M.P. The annual salary of the High Commissioner for India is £3000; the post has been held since its creation by Sir William Stevenson Meyer, G.C.I.E.

India-rubber. See *Rubber*.

In′dicator, an instrument, invented by James Watt, to record graphically the pressure-volume changes of the steam, gas, &c., in an engine cylinder. The illustration shows the construction of a modern type of steam-engine indicator. The small cylinder A is connected to the engine cylinder through a cock by means of the coupling D, and the pressure of the steam will act on the under side of the indicator piston B. Above the piston atmospheric pressure is maintained. The spring C controls the movement of the piston, and is compressed an amount proportional to the effective pressure. A strong spring is used, as the pressure changes are rapid and great, and the resulting small movements are multiplied by a lever system EG. A pencil G at the end of the lever records the pressure changes. The drum of the instrument is turned back and forward by a cord H attached to a reducing gear, which gives a reduced copy of the piston movements. If a piece of suitable paper is put on the drum, and the pencil held against it during the performance of a complete cycle, a closed diagram will be obtained, which is known as the indicator diagram. The indicator diagram is used to obtain the average or mean effective pressure on the engine piston, and to study the time of action of admission, exhaust, &c., in the cycle. —Cf. R. Royds, *The Testing of Motive Power Engines*.

Indicator, in chemistry, the name given to the third substance which is added to a mixture of two others, in order to tell when the reaction between the two latter is complete. The indicator usually acts by exhibiting some characteristic colour change. When dilute caustic soda solution is added to dilute sulphuric acid, it is difficult to tell the exact point at which all the acid is neutralized, but if a few drops of an indicator, such as litmus, are added, the point of neutralization is readily determined, since the litmus gives a red colour with the acid, but immediately this is neutralized the colour changes to blue.



Section of a Steam-engine Indicator

Indicator. See *Honey-guides*.

Indiction, in chronology, a period or cycle of fifteen years, supposed to relate to some judicial acts, probably the publication of tariffs of the taxes which took place at stated intervals under the Greek emperors. Three sorts of indiction are mentioned: (1) the Cæsarean, which fell on the 8th of the calends of October, or 24th of September; (2) the indiction of Constantinople (beginning A.D. 312), on the 1st of September; and (3) the pontifical or Roman, which begins on the calends of January. We find ancient charters in England dated by indictions.

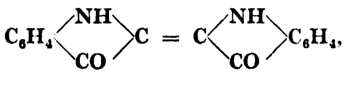
Indictment (in-dīt′ment), in law, a written accusation of one or more persons for a crime or misdemeanour, preferred to and presented upon oath by a grand-jury to a court. In Scotland the indictment is addressed to the prisoner directly by name. Indictments had formerly to be written on parchment, and all minute particulars of the offence specified. By the Indictments Act of Oct., 1915, indictments could be written on paper, and they were also made less formal.

Indigirka, a river of Eastern Siberia, flowing northwards into the Arctic Ocean; length, 750 miles.

Indigo (*Indigofera tinctoria*), showing Flower and Fruit

In′digo has long been extensively employed in dyeing and calico-printing on account of the quality and fastness of the colour obtained from it. It is present in the woad plant, *Isatis tinctoria*, which is still cultivated to a certain extent in England. It is also largely prepared from various leguminous plants of the genus Indigofera, herbaceous or shrubby plants with pinnate leaves and small pea-shaped flowers disposed in axillary racemes, which occur in India and other tropical countries. *Indigofera tinctoria* is the species most abundantly cultivated. The plant is of a perennial nature, but is usually reared from seed sown twice each year. The indigo is present mainly in the leaves in the form of a complex glucoside indican, from which it is obtained in the free state by a process of fermentation. The cut plant is steeped in vats for about twelve hours, and the fermented extract, which is of a yellowish-green colour, run off into fresh vats and agitated with air. The liquid turns green and finally blue with deposition of the indigo in the form of a mud. This is boiled up with water, allowed to settle, pressed and cut into cubes which are dried and sent into the market. Thus obtained, indigo forms dark-blue to purplish-violet lumps which show a bronzy lustre when rubbed. In addition to the essential constituent indigo-blue, which is present to the extent of about 60 per cent, natural indigo contains indigo-red and indigo-brown, together with a small proportion of mineral matter and moisture.

In 1870 Baeyer prepared synthetically a substance, indigotine, having the formula:



$$C_6H_4\left<\begin{matrix}NH\\CO\end{matrix}\right>C = C\left<\begin{matrix}NH\\CO\end{matrix}\right>C_6H_4,$$

which is identical with indigo-blue. Since then many processes have been devised by which artificial indigo is manufactured on a commercial scale. As a result, the export of natural indigo from India has fallen very considerably, and at present about 90 per cent of the world's supply is obtained from artificial sources. Originally the greater part of the synthetic supply was manufactured by the Heumann synthesis, in which naphthalene is used as the starting-point, but, owing to the great rise in the price of this material, it has been largely superseded by another process depending on the use of aniline, chloracetic acid, and sodamide.

Indigotine is insoluble in all the ordinary solvents; it has no affinity for fabrics of an animal or vegetable nature, and can only be fixed on them by a process known as vat-dyeing. The indigo is first reduced to indigo-white, which is dissolved in an alkaline liquid to form a colourless solution known as the indigo vat. The material to be dyed is immersed in the vat and wrung out, the indigo-white absorbed being readily oxidized by the air to indigo-blue, which is insoluble, and thus cannot be removed from the fibre by washing. On treatment with fuming sulphuric acid, indigo dissolves to form indigo sulphonic acid, the sodium salt of which, known as indigo carmine or indigotine, is largely used in dyeing and ink manufacture.

In′dium, a metal discovered by Reich and Richter in 1863 by means of spectroscopic analysis in the zinc-blende of Freiberg. It has a silver-white colour, is soft, and marks paper like lead; specific gravity, 7·42; melting-point, 155° C. The metal is related to aluminium, and its spectrum exhibits two characteristic lines, one indigo and another blue. Salts of indium colour the Bunsen gas-flame dark blue. Its chemical symbol is In, atomic weight 114·8.

Individualism is the doctrine which places the individual unit above the whole constituted by the separate units. It is a collection of theories based upon the principle of individuality and according to which the individual is an end in himself, all social forms, such as family, association, state, religion, law, morality, and customs, being only a means for the development of the individual. They are created by him and for himself, and are kept up or modified by him in his own interest. In philosophy (metaphysics) individualism is the theory which, in the physical as in the spiritual world, grants only to individuals or self-determined units (monads, or atoms) an independent existence, considering the whole merely as an aggregate of so many units or individuals. Opposed to this theory is the doctrine of *universalism*, which maintains that only the universe as a whole has a substantial existence, whilst the units constituting the whole are mere modifications, fleeting waves in the vast ocean of universality. Thus Protagoras, who said that man is the measure of all things, the Atomists, Leibnitz, and others were all individualists, whilst the monistic systems, or the doctrines which see in the universe a manifestation of a simple principle, are opposed to metaphysical individualism. Opposed to it is also the system of pantheism, which admits only of one universal reality, one substance, namely God.

In ethics, or morality, individualism is the tendency to look upon the individual as an end in himself, to consider social life as of no importance as compared to the life of the individual, and to subordinate the good and welfare and happiness of society to those of the individual. This, however, does not necessarily imply absolute selfishness or egoism. Moral individualism is not always synonymous with egoism, although extreme moral individualism involves selfishness. 'The greatest happiness of the greatest number' is a doctrine to which the individualist, too, may subscribe, but to him the greatest number consists of separate, independent units. In aiming at the happiness of the greatest number, the individual welfare of the separate units has to be taken into consideration. Moral individualism means, in other words, that the interests of the individual must not at any moment be sacrificed in the interests of the collectivity, since this collectivity, being an aggregate of individuals, loses its *raison d'être* once the rights of the single individual are ignored. Moral individualism involves a criticism of existing ethics, of national customs, and of traditions. It maintains that since moral obligation is born in the individual conscience, 'a man's ideals are the measure of his morality'.

This tendency or doctrine of moral individualism has been expressed by philosophers of all ages, by the Sophists, the Cynics, the Stoics, the Epicureans, Plotinus, Leibnitz, and Wolf. It has passed through many phases, from the moral individualism of Socrates to that of the Renaissance, which represented the growth and development of individualism and the emancipation of the individual from ecclesiastical bondage; from Kant's moral to Nietzsche's immoral individualism; and from the individualism of Abélard to that of Max Stirner. Altogether it may be pointed out, *en passant*, that the philosophy and the literature of the second half of the eighteenth and of the first half of the nineteenth centuries were favourable to moral individualism.

Politically and economically individualism is the antithesis of collectivism. It is the system which considers the State as the mere guardian of the rights of the individual, and even as a means calculated to serve individual ends. Political individualism does not always oppose sovereignty of government. We have an example in the teaching of Hobbes, who, in spite of his individualism, was a supporter of government and even of despotism. Whilst moral individualism teaches that social life is of no importance as compared to that of the individual, political individualism advocates individual liberty, but only as far as it is compatible with the freedom of others and the welfare of the State. Man being bad from the beginning, and requiring a restraint for his selfish tendencies, many individualists admit the usefulness of government as a necessary evil. But just as extreme moral individualism leads to selfishness, extreme political individualism culminates in anarchism, which rebels against restraints imposed by the State upon the freedom of action of the individual, and repudiates the right of society to impose any such restraints.

Economically individualism advocates economic freedom, individual initiative, and the non-interference of the State in the economic machinery, production, distribution, or consumption. It demands the absolute freedom of the individual to sell and buy labour as dearly or as cheaply as the economic market would allow him. Free play to individual energy, ample scope given to the individual citizen freely to pursue his enlightened interest, and free competition will necessarily result—so the economic individualists maintain—not only in the survival of the economically fittest, but in the happiness of the greatest number and the welfare of the State. Economic individualism is thus opposed to socialism, to State legislation, and minimum wage. The doctrine was developed during the eighteenth century and was expressed in the famous formula of *laissez faire* (q.v.), as taught by the Manchester school, a doctrine involving the minimization of State interference. Economic individualism was derived from the political philosophy of the eighteenth century, and its exponents were Adam Smith (*Wealth of Nations*), Bentham, Ricardo, and the elder Mill, who derived his views from Adam Smith, and notably Herbert Spencer (*The Man versus the State*) in this country, and Bastiat in France. They opposed not only public enterprises, State railways, telegraphs, and so on, but also restrictive legislation, such as factory laws, and laws regulating the hours of labour for women and children. A reaction, however, has set in since the end of the nineteenth century, since the progress of socialism and the development of democratic principles. The tendency is now, even in the so-called bourgeois states, as distinguished from socialist and Soviet republics, to legislate in the spirit of collectivism and of State interference.—BIBLIOGRAPHY: Adam Smith, *Wealth of Nations*; H. Spencer, *The Man versus the State*; W. Fite, *Individualism*; W. Donisthorpe, *Individualism: a System of Politics*; E. Fournière, *Essai sur l'Individualisme*; V. Basch, *L'Individualisme anarchiste.*

Indo-Germanic Languages, alternatively, **Indo-European,** the most important of the great families into which human speech has been divided, spoken by various peoples in Asia and Europe. The chief branches of this family are the Teutonic or Germanic, including English, German, Dutch, Danish, Swedish, Icelandic, and the extinct Gothic; the Slavonic (Polish, Russian, Bohemian); the Lithuanian; the Celtic (Welsh, Irish, Gaelic, Breton); the Latin or Italic, and the Romance tongues descended from it (French, Italian, Spanish, Portuguese); the Greek, the Armenian, the Persian, and the Sanskrit. All these tongues are regarded as being descended from a common ancestral tongue or parent speech, spoken at some remote period in Central Asia, whence the ancestors of the modern peoples speaking these tongues spread into India, Western Asia, and Europe. The term Indo-European is no longer used, except by Italian and French scholars.—BIBLIOGRAPHY: W. Z. Ripley, *The Races of Europe*; G. Sergi, *The Mediterranean Race*; O. Schrader, *Prehistoric Antiquities of the Aryan Peoples*; J. M. Edmonds, *Introduction to Comparative Philology.*

Indore, or **Indor,** a protected native state of India, connected with Central India, and consisting of several detached portions, the largest being bisected by the Narbada; total area, 9506 sq. miles. It forms the remnant of the sovereignty of the Mahratta dynasty of Holkar, and Holkar as the family name is associated with the title Maharajah, which belongs to the ruler of the state. It is traversed by the Vindhya Mountains, and much of the country is well wooded. Indore is generally fertile, the cultivated crops including wheat, rice, millet, cotton, sugar-cane, oil-seeds, tobacco, and opium, which is one of the principal products. Amongst the inhabitants are numerous Bheels. The ruling class are Mahrattas. The Holkar dynasty was founded by Mulhar Rao in the early half of the eighteenth century, its dominions being at one period much more extensive than at present. Pop. 1,004,569.

Indore, the capital of the state of Indore, is of modern origin. The Maharajah's palace is the most conspicuous building. The British Residency is one of the handsomest in India. Pop. 45,000.

Indra, the great national god of Vedic India. He lost his supremacy through the rise of Brahma, Vishnu, and Siva, but he is still a figure in the Hindu Pantheon. Originally he represented the sky or heavens, and was worshipped in the Vedic period as the supreme god. He is commonly represented with four arms and hands riding on an elephant; in two hands he holds a lance, and in the third a thunderbolt. When painted he is covered with eyes; he is then called Sahasraksha, or 'the thousand-eyed'. He is at once beneficent as giving rain and shade, and awful and powerful in the storm as wielding the thunderbolt. In one aspect he is lord of *Swarga,* the beautiful paradise where the inferior gods and pious men dwell in full and uninterrupted sensuous felicity. — BIBLIOGRAPHY: W. J. Wilkins, *Hindu Mythology, Vedic and Puranic*; J. Dawson, *A Classical Dictionary of Hindu Mythology and Religion.*

Indra—Colman's Hindu Mythology

Indre (aṇdr), a department of Central France; area, 2664 sq. miles. It belongs to the basin of the Loire, which receives its waters by the Indre, a river of 140 miles length, the Creuse, and the Cher. The department is generally flat, and nearly two-thirds of the surface is arable. Large crops of wheat and barley are produced; other important crops are hemp and flax. A considerable quantity of land is occupied by vineyards. The minerals include iron, lithographic stones, and several varieties of marble. The principal manufactures are fine woollen cloth, and iron and steel goods, linen, and hosiery. Châteauroux is the capital. Pop. 260,535.

Indre-et-Loire (aṇdr-ê-lwär), a department of Central France; area, 2377 sq. miles. It belongs to the basin of the Loire, and is traversed both by it and its tributary the Indre, as also by the still more important tributaries the Vienne and the Creuse, besides the Cher. They are all navigable within the department, and furnish it with almost unlimited means of water communication. The surface is finely diversified, and more than one-half is arable. Hemp and flax are extensively cultivated, and fruit is very abundant. Iron is worked to some extent; and there are valuable millstone quarries. Clay, both for ordinary purposes and the finer kinds of pottery, is abundant. The manufactures are not of much importance. Tours is the capital. Pop. 327,743.

Induced Current, the current of electricity which is produced or excited in a conductor when the magnetic field in which it is placed is altered in any way; that is, first, when the strength of the current in a neighbouring conductor is altered; or, second, when a neighbouring conductor in which a current flows is altered in position; or, third, when a neighbouring magnet is moved; or, fourth, when the magnetization of a neighbouring magnet is altered. Thus if there is a closed circuit, say a coil of wire with its ends joined, through which no current is passing, the motion of a magnet in its neighbourhood will induce a current in it, the direction of this current being always such as to oppose the motion. See *Magnetism*; *Electromagnetism*; *Electromotive Force*; *Generator*; *Inductance*.

Inductance, or coefficient of self-induction, of an electric circuit may be defined either as the magnetic flux which threads the circuit in consequence of the flow of unit current in the circuit, or as the back E.M.F. induced in the circuit when the current is changing at unit rate. More generally, flux = inductance × current, and back E.M.F. = inductance × time rate of increase of current. In the practical system the unit of inductance is the *henry*, which is the inductance of a circuit in which the induced E.M.F. is 1 volt, when the current changes at the rate of 1 ampere per second. The inductance of a circuit has an important influence when the circuit is carrying an alternating current. The following is a brief sketch of the theory.

Let resistance = R ohms; inductance = L henrys; and, at time t seconds, let current = i amperes, and applied E.M.F. = e volts. The induced back E.M.F. is $L(di/dt)$. The applied E.M.F. has to drive the current against the back E.M.F. and the resistance. Hence $e = L(di/dt) + Ri$. In the simplest case e is sinusoidal, or $e = E \sin pt$, where E is constant. Here e goes through all its phases in time $2\pi/p$, so that there are $p/2\pi$ cycles per second, and $p = 2\pi k$, where k = number of cycles per second. The differential equation for i is now

$$L(di/dt) + Ri = E \sin pt.$$

The complete solution is:

$$i = Ae^{-Rt/L} + E(R \sin pt - Lp \cos pt) \div (L^2p^2 + R^2),$$

where A is a constant. The first term, that involving A, becomes very small as t increases (for the study of this term, see C. P. Steinmetz, *Transient Phenomena*), and in the steady state the value of i is given by the second term alone. Introducing an auxiliary angle α, such that $\cos\alpha = R \div \sqrt{(L^2p^2 + R^2)}$, $\sin\alpha = Lp \div \sqrt{(L^2p^2 + R^2)}$, $\tan\alpha = Lp/R$, we get for the steady value of i,

$$i = E(\sin pt \cos\alpha - \cos pt \sin\alpha) \div \sqrt{(L^2p^2 + R^2)} = \{E/\sqrt{(L^2p^2 + R^2)}\} \sin(pt - \alpha).$$

If we write I for $E/\sqrt{(L^2p^2 + R^2)}$, this becomes $i = I \sin(pt - \alpha)$. The phase of i, viz. $pt - \alpha$, is α behind the phase of e; α is called the *lag* of the current behind the voltage. If L is zero, i.e. if the inductance is negligible, the value of I becomes E/R instead of $E/\sqrt{(L^2p^2 + R^2)}$. Thus, in the inductive circuit, the quantity $\sqrt{(L^2p^2 + R^2)}$ takes the place held by the resistance R in a non-inductive circuit. The quantity $\sqrt{(L^2p^2 + R^2)}$, usually denoted by Z, is called the *impedance*, in a circuit of resistance R and inductance L. Lp is called the *reactance* (q.v.), so that $(\text{impedance})^2 = (\text{resistance})^2 + (\text{reactance})^2$. The energy lost by the circuit, per cycle $= \int ei \cdot dt$, over 1 cycle $= \int L(di/dt)i\, dt + \int Ri \cdot i\, dt$. The integral containing L is zero, for $i\, di/dt$ is the derivative of $\frac{1}{2}i^2$, which has the same value at the beginning as at the end of a cycle. (Otherwise, the phase of the induced E.M.F. is 90° behind the phase of the current, since $-\cos(pt - \alpha) = \sin(pt - \alpha - 90°)$; E.M.F. and current are in this case said to be in *quadrature*, and the work done is easily proved to be zero.) Hence energy lost by circuit $= \int Ri^2 dt = \frac{1}{2}RI^2$, which, from the values given above for $\cos\alpha$ and I, is at once seen to be $= \frac{1}{2}IE \cos\alpha$. This can be written $(I/\sqrt{2})\,(E/\sqrt{2}) \cos\alpha$ = (root-mean-square current) · (root-mean-square voltage) · $\cos\alpha$.

The root-mean-square current and voltage are those read from an ammeter and voltmeter. The apparent watts = measured amperes × measured volts = $\frac{1}{2}IE$; the true watts = $\frac{1}{2}IE \cos\alpha$ = apparent watts × *power factor*, where the power factor is $\cos\alpha$. See *Electromagnetism*; *Electromotive Force*; *Impedance*;

Impedance Coils; *Generator*.—BIBLIOGRAPHY: M. Maclean, *Electricity and its Practical Applications*; F. B. Pidduck, *A Treatise on Electricity*; C. P. Steinmetz, *Alternating Currents*; C. G. Lamb, *Alternating Currents*.

Induction, in logic, is that process of reasoning by which we rise from the particular to the general, and is the counter-process to deduction. In induction particulars are not only raised into generals, but these into still higher generalities. In following this method we proceed from the known to the unknown, and obtain a conclusion much wider than the premises. Thus a person who has had any experience easily arrives by induction at the conclusion that fire burns wood, and when any piece of wood whatever is presented to him, he will have no hesitation in saying that fire will burn it. As it is impossible that all particulars can be observed, there is always a certain risk of error, and the inductive method must be worked with extreme caution; but science properly so called would be impossible if we did not presuppose a faculty of arriving from experience at the knowledge of truths not contained in that experience. Hence the ground of induction is the established fact that nature is uniform.

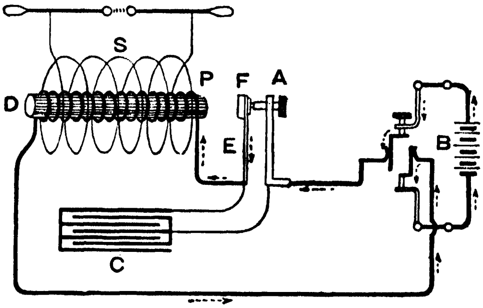
Induction, in English ecclesiastical law, the investing of a clerk presented to a benefice with the temporalities thereof. The person inducting takes the clerk by the hand, and lays it on the ring, key, or latch of the church-door or wall of the church; or he delivers a clod, turf, or twig of the glebe, and thus gives corporal possession of the church. The doors are then opened, the clerk put into the church, and the bell tolled to make the induction known. The incumbent must assent to the Thirty-nine Articles and the *Book of Common Prayer*, and take the oath of allegiance. In Scotland the minister is inducted by the presbytery.

Induction, Electromagnetic. See *Induced Current*; *Electromotive Force*.

Induction, Electrostatic. See *Electricity* under heading *Electrostatics*.

Induction, Magnetic. See *Electro-magnetism*; *Magnetism*.

Induction Coil, an electrical apparatus which is used to transform intermittent currents of low voltage into intermittent or oscillatory currents of high voltage. It is employed in producing X-rays, and as part of the transmitting mechanism in wireless telegraphy, also for causing ignition in internal-combustion engines, for the study of electric discharges in vacuum tubes, and for the production of faradic and high-frequency currents for therapeutic purposes. The induction coil consists of an inner or primary coil with a core of iron wires. Round the primary coil and insulated from it is the secondary coil, which is built up, in partitioned sections, of a large number of turns of fine wire. The current in the primary coil undergoes periodic interruptions caused by an automatic device which makes and breaks the current. In the hammer break shown in the figure, which represents diagrammatically the different parts of an induction coil, when the current flows from the battery B through the primary coil P, the soft-iron mass F is attracted to the wire core D, and the current is thus broken at the contact A. On the current stopping, the mass F ceases to be attracted, and the spring E causes contact to be made again at A. This action causes the iron core to be magnetized at make, and to be demagnetized at break, and these rapid changes in magnetization create induced currents in the secondary coil S, the current flowing in one direction through S at make, and a stronger current flowing in the opposite direction at break. The condenser C is generally connected across the interrupter FA, as in the figure; it tends to quench the spark which occurs at break, and thus to increase the electromotive force of the corresponding induced current in the secondary. After interruption the current in the primary coil flows into the condenser and becomes oscillatory, and by induction an oscillatory current is generated in the secondary; this secondary current has two components with different frequencies. Besides the hammer break, also known as the trembler or buzzer, the mercury interrupter and the electrolytic interrupter are employed to break the primary current. In certain respects these are more satisfactory devices than the hammer break for prolonged working of a coil. The output of an induction coil is commonly gauged by the length of spark which the secondary coil can make in air. The largest coil made was that constructed by Apps for Spottiswoode in 1876, which had a secondary coil containing nearly 342,000 turns of copper wire 280 miles in length; at its best the coil gave a 42-inch spark, which was capable of penetrating 3 inches of glass.—BIBLIOGRAPHY: J. A.



Fleming, *The Alternate Current Transformer*; E. T. Jones, *Theory of the Induction Coil.*

Induction Generator, an induction motor (q.v.) driven by a prime mover above 'synchronous' speed. If such a generator is connected to a 'live' alternating-current system, it will pump electrical energy into the system. The current it delivers to the network 'leads' the pressure of the machine (see *Vectors*). It is an asynchronous machine, and hence can be used without any synchronizing gear. The machine magnetizes itself, deriving its magnetizing current from the live system, and consequently an alternating-current system could not be run entirely by means of induction generators. Direct-current generators must exist, in association with some of the alternating-current generators in use on the system, to supply the steady magnetizing current required by it. Induction generators are used to some extent in the United States, but are very rare in this country.

In three-phase electric-traction schemes the induction motors on the locomotives can be used to generate power when trains are descending gradients. This fact is one of the points in favour of the three-phase traction system for electric railways in hilly districts. Not only do the descending trains generate electrical energy, but the generation of this energy automatically 'brakes' the train, and the energy does not have to be dissipated, as it otherwise would, in heating the brakes, with consequent expensive wear and tear of rails, wheel-tyres, and brake-blocks. Such systems of traction are known as 'Regenerative Control Systems'. — BIBLIOGRAPHY: H. M. Hobart, *Polyphase Generators and Motors*; A. T. Dover, *Electric Traction.*

Induction Motor. For a general description see *Electricity*. The arrangement of the stator coils depends on whether the motor is a two- or three-phase one, and on the number of poles. In a three-phase motor, for instance, the stator is wound very much like an alternating-current generator. The conductors of each phase are disposed so that each phase is 120 electrical degrees in advance of the preceding phase. Each phase is fed with alternating current, which is one-third of a period out of phase in time with either neighbouring phase. The result of this distribution of coils and of feeding is that a magnetic field is set up which rotates about an axis parallel to the shaft at a speed corresponding to the frequency of the supply. Thus if the motor is a six-pole one and fed with 25-cycle current, the magnetic field rotates at $\frac{25 \times 60}{3} = 500$ r.p.m. The magnetic field sets up induced currents in the conductors of the rotor, with the result that the rotor races round at a speed of rotation just short of that of the field. The difference in the speeds of rotation expressed as a percentage of the speed of the magnetic field is called the *slip* of the motor.

Starting.—The *starter* of a slip-ring motor is a simple arrangement, consisting merely of a circuit breaker and an adjustable liquid or metallic resistance, which is connected to the slip-rings and can therefore be switched into the rotor circuit at will. With this starter, a high starting torque can be obtained, without taking an excessive current from the electric mains. The methods of starting squirrel-cage motors are more varied. Motors up to 5 h.p. are usually started with a single-throw switch, which need not be oil-insulated. The starting current, though *relatively* excessive, is usually not high enough to cause any difficulty in public supply-mains. Motors above 5 h.p. are usually started in one of two ways. One method is to use a *star-delta* starter if they are three-phase motors; or a series-parallel arrangement if they are two-phase motors. The star-delta starter is an arrangement for putting the stator coils in star connection at the start and in delta connection when running (see *Windings, Armature*). In this way the starting pressure applied to each phase is only some 58 per cent of the running pressure. The second method uses an *auto-starter*, which is a small oil-insulated auto-transformer. Each kind of starter is provided with a *no voltage* and *overload release* (see *Switch-gear*). The star-delta starter is suitable for voltages up to 500. It will give a starting torque of about 50 per cent of the full-load torque, the starting current being about 1·7 times to twice the full-load current. The auto-starter is more costly, but has advantages over the star-delta, viz. the voltage applied at starting can be varied so as to get the exact starting torque required, and the line current is therefore kept to the minimum.

Operating Data.—The following operating data may be useful to users of these motors. *Slip*: 7 per cent for small motors; 4 per cent for large motors (5 to 100 h.p.) at full load. *Stalling torque*, i.e. the maximum torque the motor will give without stopping, is about 2½ times the full-load torque. *The usual temperature rise for induction motors* is about 40° C. at normal full load. The temperature rise goes up some 2½ per cent for 1 per cent increase of output, up to a temperature rise of, say, 50° C. *Overloads*: Induction motors can carry a 25 per cent overload for half an hour, a 50 per cent overload for a quarter of an hour, and a 100 per cent overload momentarily. *Power factor and efficiency* depend greatly upon the output of the motor. Usual figures for a 20-h.p. motor at full load would be about 96 per cent efficiency and 92 per cent power factor.—Bibliography: H. M. Hobart, *Electric Motors*; C. P. Steinmetz, *Alternating Currents*. Much useful data can also be found in the standard specification for electrical machinery issued by the British Engineering Standards Committee.

Indulgence, in the Roman Catholic Church, is the remission granted by the Church to a repentant sinner, of the temporal punishment due to his sin, whether this punishment be the pains of purgatory, or penance which the Church has the right to impose according to the gravity of the sin. It must be understood that the indulgence is never to be considered as constituting a remission of the sin itself. The principle of indulgences rests on that of good works. Many saints and pious men have done more good works and suffered more than was required for the remission of their sins; these are known as *works of supererogation*, and the sum of this surplus constitutes a treasure for the Church, of which the Pope has the keys, and is authorized to distribute as much or little as he pleases in exchange for pious works or gifts. Indulgences are of two kinds: *plenary*, when considered an equivalent substitute for all penance; and *partial*, when only a portion of penitential works is relaxed. *Local* indulgences are attached to particular places, *real* indulgences to crucifixes, medals, &c. The historical origin of indulgences is traced to the public penances and the canonical punishments which the early Christian Church imposed on offenders, especially on those who were guilty of any grievous crime, such as apostasy, murder, or adultery. When ecclesiastical discipline became milder, it was allowed to commute these punishments into fines for the benefit of the Church. The first recorded instance of the use of the name indulgence was by Alexander II in the eleventh century, and the institution itself was in full development during the Crusades. At first the only source of indulgences was in Rome, and they could be obtained only by going there. The abuse of the system of granting indulgences, known as the 'sale of indulgences', inflamed the zeal of Luther, and the Protestant theologians have always found indulgences one of the most vulnerable points of the Roman Catholic system. —Cf. H. C. Lea, *A History of Auricular Confession and Indulgences in the Latin Church.*

Indus, the chief river of north-west Hindustan. It has a length of about 1800 miles, drains an area of about 372,000 sq. miles, and rises north of the Himálaya Mountains, in Tibet. At first it flows in a north-westerly direction, but after bursting through the Himálaya flows south-west till it enters the Indian Ocean. At Attock it is joined by the Kabul from Afghanistan, and here, 950 feet above the sea, it is nearly 800 feet wide, and from 30 to 60 feet deep according to the season. Near Mittankot it receives on the east the Panjnad, or united stream of the 'Five Rivers' of the Punjab. In Sind it gives off several extensive arms or canals, which are of great value for irrigation; and below Hyderabad it divides into a number of mouths. Its delta extends about 130 miles along the coast. Vessels drawing more than 7 feet cannot generally enter any of its mouths; but steamers of light draught ascend from Hyderabad to Multan. The river is spanned by several bridges, the chief being the cantilever bridge of Sakkar.

Industrial and Provident Societies, societies that carry on some trade for the mutual benefit of the members. In Great Britain various Acts have been passed for the regulation of such societies, the most important being in 1893, amending and consolidating all previous Acts. The societies which may be registered under this Act are societies for carrying on any industries, businesses, or trades specified in or authorized by their rules, whether wholesale or retail, of which societies no member other than a society registered under this Act shall have or claim an interest in the funds over £200. No society can be registered which has fewer than seven members; and every society must have a registered office; must publish its name (with 'limited' added) outside the office and elsewhere; must submit its accounts to an annual public audit; and must send annual returns to the registrar. A register of the members' names must be properly kept. The registrar, on application of one-tenth of the members, may, with the consent of the Treasury, appoint one or more inspectors to examine the affairs of the society and report thereon. No registered society which has any withdrawable share capital shall carry on the business of banking. Every registered society which carries on the business of banking must on the first Mondays in February and August in each year make out and keep conspicuously hung up in its registered office a statement in a prescribed form showing its assets and liabilities. The taking of deposits of not more than ten shillings in any one payment, nor more than twenty pounds for any one depositor, payable on not less than two clear days' notice, is not regarded as 'banking'; but no society which takes such deposits can make any payment of withdrawable capital while any claim due on account of any such deposit is unsatisfied.

Industrial Schools. John Pounds, a poor shoemaker of Portsmouth, planted the germ of what afterwards became the industrial school in this country. He died in 1839, and for twenty years before that he gathered the ragged children of the district around him as he sat at work. They came freely and were taught gratuitously. The success attending his humble efforts soon led many more influential friends of the ' outcasts ' to engage in the same work. In 1838 London had a ragged Sunday school, which eventually became a free day school. Field Lane followed in 1843. But the first ragged feeding school was opened in 1841 by Sheriff Watson in Aberdeen. In 1845 the Rev. Dr. Robertson, not then aware of the existence of Sheriff Watson's, opened a similar school in the Vennell, Edinburgh. Soon after, Dr. Guthrie's famous *Plea for Ragged Schools* appeared, a work which gave an irresistible impulse to the movement, and caused the author to be generally regarded as the father of ragged schools. A ragged school was founded at the Castle Hill in 1847—transferred to more suitable, because specially built, premises at Liberton in 1887. After this ragged schools spread over the land, until there was scarcely a town of any importance that had not one or more. Dr. Guthrie was also successful in obtaining from the Treasury a grant for *maintenance*—a grant which has been continued to all certified industrial schools. The finding of suitable buildings, equipment, &c., was still left to voluntary effort. Compulsory attendance at school, introduced in England in 1870 and in Scotland in 1872, practically compelled the larger School Boards to build and equip more commodious industrial schools, and this in turn led to the gradual closing of some of the older schools which had done good work in their day. All this time industrial schools were under the supervision of the Home Office, but have recently (1921) been put in charge of the Board of Education in England and the Scottish Education Department in Scotland. Children sent to industrial schools are not criminal in any sense of the word, but children who are not under ' proper guardianship ', whether due to the death or misconduct of parents, or those who are waifs and strays.

Industrial Villages, villages established for the amelioration of the condition of the working-classes and for giving the workers a better opportunity of bringing up their families in good surroundings. The conditions of the labourer in the early days of the factory era were often deplorable, and many attempts at improvement have been made. Robert Owen was one of the first to show regard for his work-people at the mills of the New Lanark Twist Company. Sir Titus Salt, also, founded in 1853 the village of Saltaire for his woollen operatives. A more modern instance is Port Sunlight, started in 1888 by Mr. W. H. Lever (now Lord Leverhulme). Port Sunlight has been built for the work-people at the great soap-factory, and the houses are let at low rents only sufficient to cover the cost of repairs and maintenance without giving any return on the capital expended in building the houses. The village is arranged on ' town-planning ' lines. Each house has a garden, and there are numerous allotments for those desirous of cultivating the soil. Numerous public buildings have been built—a library and museum, entertainments' hall, hospital, men's club, schools, and a church.

Bournville, started by Mr. George Cadbury in 1879 and developed from 1894 onwards, is another example. In this case the houses are not reserved for the workers at the Bournville Cocoa Factory, but are available for all workers, while rents are on an ' economic ' basis. The houses have gardens back and front, which are cultivated by the tenants. Public buildings are the schools, Ruskin hall, the inn, and the meeting-house. An interesting feature of Bournville life is the village council, a committee elected by the householders to further the interests of the village.

Other examples of 'industrial villages' are New Earswick, near York, and Woodlands, near Doncaster, a model colliery village. On the Continent the most important experiments are those carried out by the firm of Krupp at Essen. In the early 'sixties the firm built cheap and ugly but serviceable barracks, but from 1890 onwards the 'garden district' idea was applied, and neatly-designed houses with beautiful gardens have been erected.

Inertia, that property of matter in virtue of which a body remains in its state of rest, or of uniform motion in a straight line, unless it is compelled by force to change that state. This law of inertia is the first of Sir Isaac Newton's three Laws of Motion (q.v.). The inertia of a body is measured by its mass.

Inertia, Moment of. If a material body is divided into a large number of parts, all very small, and if the mass of each of these parts is multiplied by the square of its distance from a given line or axis, then the sum of all these products is called the moment of inertia of the body about the axis, or $I = \Sigma(mr^2)$. The moment of inertia has the same importance (i.e. moment), in motions of rotation about the axis, as inertia itself (i.e. mass) has in motions of translation. When a body, free to rotate about a fixed axis, is subjected to force, then its angular velocity about the axis is accelerated, and angular acceleration = (moment of applied forces) ÷ moment of inertia, both moments being taken about the axis of rotation. See *Kinetics*.

Infallibility, exemption from the possibility of error in regard to matters of religion and morals—a claim made by the Roman Catholic Church both on its own behalf and on that of the Pope when speaking *ex cathedra*, or in his official capacity. The infallibility of the Church is of two kinds, *active* and *passive*; the former signifying the function of the Church of permanently teaching the truths of God, and of authoritatively settling doctrinal disputes; and the latter that property inherent in the Church in virtue of which she can never receive or embrace erroneous doctrines. The infallibility of the Pope, long taught, was only settled as an article of faith in the Vatican Council of 1870. The dogma was then formulated in the following terms: " We teach and define that it is a dogma divinely revealed; that the Roman pontiff, when he speaks *ex cathedra* — that is, when in discharge of the office of pastor and doctor of all Christians, by virtue of his supreme apostolic authority, he defines a doctrine regarding faith or morals to be held by the Universal Church, by the divine assistance promised to him in blessed Peter—is possessed of that infallibility with which the Divine Redeemer willed that His Church should be endowed for defining doctrines regarding faith or morals, and that, therefore, such definitions of the Roman pontiff are irreformable of themselves, and not from the consent of the Church ". A considerable body who refused to accept the infallibility of the Pope as one of the dogmas of the Church formed themselves into a separate Church calling themselves Old Catholics (q.v.).—BIBLIOGRAPHY: Mgr Joseph Fessler, *La Vraie et la Fausse Infaillibilité*; G. Salmon, *The Infallibility of the Church*; J. R. Illingworth, *Divine Transcendence*.

Infant, a term in the English and American law for persons who have not attained their *majority*, that is, the age of twenty-one years, and are under guardianship. In general, contracts made by infants are not binding, except for necessaries suited to their state in life and beneficial contracts of service. Being an infant is no bar to criminal proceedings or to actions of tort; but young persons are not punished for offences if they have not knowledge and discretion to distinguish them to be such. Infants require the consent of parents or guardians to marry. The jurisdiction in respect to infants is generally vested in either probate or orphans' courts. These courts appoint guardians to take charge of the property of infants, and, in case of the decease of the father, to take charge of their persons; but during the life of the father he has the guardianship and control of the persons of his children until they are twenty-one years of age. An infant, other than a soldier on service or a marine or seaman at sea, cannot make a valid will. Full age is attained on the day preceding the twenty-first birthday.

Infan'ticide (Lat. *infans*, infant, and *cædere*, to kill), the murder of an infant, a crime that is especially common in the case of illegitimate children, the main cause being shame; but infanticide is sometimes the result of puerperal insanity. In trial for infanticide it must be proved that the child was fully born alive. Infanticide was prevalent in Greece and Rome. In modern times many barbarous nations are guilty of wholesale child-murder. Among the South Sea Islanders and aboriginal Australians the destruction of infant life is systematized. The Hindus destroy female children without compunction, and abortion is common among the Mahommedans. In China, also, infanticide is supposed to be of common occurrence.

Infant Mortality. Strictly speaking, the phrase means mortality of babies less than one year old, the infant mortality figure being

$$\frac{\text{Deaths of children under 1 year}}{\text{Number of births}} \times 1000$$

for the period and locality under review. Thus mortality of babies over twelve months is excluded.

Until the year 1905 no special efforts had been made to reduce the infant mortality figure, although Medical Officers of Health in different parts of the country had directed attention to the lamentably excessive numbers of baby deaths. Prior to that period, out of seven babies born in England and Wales only six attained their first birthday on an average, while during unfavourable summers in industrial towns infants died in such numbers that if the rate had continued during the other seasons of the year, the whole infant generation of that year would have been eliminated from the population.

During recent years such an improvement has occurred that at least nine out of ten babies may be expected to complete their first year of life. The conditions which permitted the former deplorable state of affairs were ignorance, apathy, and the idea that death is inevitable.

A close consideration of the components of the infant mortality figure made it clear that a considerable proportion of the deaths of babies resulted from causes which were clearly and readily preventable. Constitutional or inherited diseases, developmental imperfections, and suchlike, only accounted for a relatively small proportion of the deaths, while diseases of the intestinal tract, coupled with malnutrition indicating improper feeding (an examination of 1000 consecutive *deaths* under one year of age showed that only one out of sixteen had been breast-fed—the remaining fifteen being artificially fed), and diseases of the respiratory system indicating improper exposure to bad weather, constituted the bulk of the deaths.

Of late years the subject has attracted much public attention—largely as the result of national and international congresses, as well as of much attention being directed to it in the press. To-day officers of sanitary authorities, whose duties are exclusively directed to ameliorate the conditions of infancy, are generally employed—every city, every county, and every county borough has departments specially devoted to this work. At the same time voluntary agencies have grown up in large numbers—mothers' clubs, babies' welcomes, infant-welfare centres, day nurseries, and clinics *et hoc genus omne* abound, especially in our large cities, where their activities are likely to be most useful.

In′fantry, the foot-soldiers of an army. It is impossible, within the scope of this article, to trace the history of infantry back through the centuries, nor does it appear to be necessary; but, in order to show that the essential principle of infantry work is much the same in the twentieth century as it was in the tenth, it is advisable to take a glance at the Saxon era of our history, and to note very generally the growth and development of the arm to comparatively modern times, when infantry assumed the principal rôle in battle. In Saxon times an obligation to defend his country when required was admitted by every free man, and when all men were armed and were familiar with the use of some weapon or other, an army was almost entirely composed of foot-soldiers. These brought with them the particular form of weapon in which they put their trust, and formed themselves into bodies of varying sizes under their county magnates or thanes. These thanes, who acted as officers, were in most cases mounted, but in general their horses were used merely as a means of locomotion, and when it came to a question of fighting, the thane left his horse and fought on foot with his men in exactly the same manner that infantry mounted officers do in these days. The one idea was to get to close quarters with the enemy, kill or capture him in a hand-to-hand encounter, and so win the battle. That this is the same principle which is still in favour is evident from the following extract from the British Field Service Regulations: "The main object of the infantry . . . is to close with the enemy and destroy him by killing or capture". Fighting in those days was largely a matter of personal prowess, and, as neither side could manœuvre and there was no discipline, it became merely a question of which could hit harder and stand more punishment. In these days, though we have advanced far in our methods and means of death-dealing and can fight and inflict losses from a great distance, personal prowess and the power to hit hard and endure are still of value, for it is an axiom that decisive success cannot be won by fire alone. With the Norman Conquest came the fashion of fighting on horseback, both horse and man being encased in armour, and for a matter of centuries the most important part of an army was its mounted contingent of knights and men-at-arms, the foot-soldiers of inferior social rank being relegated to the second place.

Gradually archers with their long-bows came to the fore, and so efficient were they that they were very largely employed in our armies to cause havoc and confusion among the opposing knights, and so afford the cavalry—the knights and men-at-arms—an opportunity of charging and completing the business. Archers were, with occasional exceptions, entirely unarmoured foot-soldiers, and for many years the bow remained the principal and most effective long-distance weapon of infantry, even after the introduction of fire-arms had caused the mounted man-at-arms to lose much of his former value and prestige; and when, towards the end of the sixteenth century, infantry had come to be organized into separate companies and regiments, the bow still retained its place as one of the five weapons to be found in each company of 100 men, the remaining four being harquebuses, muskets, halberds, and pikes; there is, moreover, little doubt that of the three missile weapons the bow was the most accurate and deadly. In the next century, as fire-arms improved, certain infantry formations began to be armed alike with some form of fire-arm, being provided also with a sword for use at close quarters. Pikemen, especially on the Continent, which was the school for war during the whole of the seventeenth century, were sometimes formed into separate battalions until, with the general introduction of the bayonet, the pike fell into disuse, and all infantry received the musket and bayonet (q.v.). The halberd was retained for many years as the weapon of the sergeants, more as a mark of rank than anything else. The modern arms of infantry are the rifle and bayonet, the Lewis-gun (q.v.), the rifle-grenade, the hand-grenade, and the light mortar, and the modern infantry soldier is trained in the use of all of these. Of these weapons the rifle and the Lewis-gun are the only ones which can be used at any considerable distance from the enemy; the rifle is sighted for 2800 yards, though seldom used at more than 800 yards; the Lewis-gun is similarly sighted, and can be conveniently used whenever a rifle can. These two form the long-distance missile arms of the modern foot-soldier, while for comparatively close quarters we have in addition the light mortar and the rifle-grenade. The bayonet and the hand-grenade are for the time—the ultimate object of good infantry—when, owing to the progress made by an attacking force, the fighting assumes a hand-to-hand character. A soldier is therefore provided with a weapon for every phase of an attack, and, in the words of the Regulations, " can develop rapidly in any direction a large volume of fire, and can combine fire and movement and engage an enemy at a distance or hand-to-hand ".

This power of combining fire and movement is a very valuable asset to infantry, and is much insisted on in regard to training in fire tactics (q.v.). The ultimate aim of infantry should be, as already noted, to come to close quarters with an enemy, i.e. ' assault, or the immediate threat of assault, is necessary to drive an enemy from the field '. The fire power of infantry may therefore almost be considered as subsidiary to its power of movement and consequent ability to approach near enough to an enemy either to (*a*) assault, or (*b*) threaten an assault. This power of movement in face of opposition depends mainly on two conditions, the first being the proper use of ground affording at least cover from aimed rifle and machine-gun fire, and the second an efficient covering fire by other troops and arms to subdue the fire of the defenders and to break down opposition. Power of movement may therefore be said to be obtained by an attacking force in proportion to the amount of assistance it can (*a*) provide for itself by its own fire immediately preceding the moment of advance; (*b*) obtain during its advance by taking advantage of the configuration of the ground; (*c*) count on receiving from neighbouring bodies of troops during the advance; and (*d*) receive from artillery, machine-guns, tanks, and aeroplanes.

In the above list (*c*) and (*d*) constitute what is known as ' covering fire ' and ' co-operation of the other arms ', and to quote again from Field Service Regulations: " Infantry is the arm which in the end wins battles. The co-operation of the other arms is necessary, but neither separately nor together can they defeat the enemy." In the case of artillery this co-operation takes the form of covering or barrage fire, or by what is known as the ' creeping barrage ', the difference between the two varieties being that in the first fire is applied in turn to definite targets, while the expression creeping barrage implies that the artillery fire is applied in the form of a wall of bursting shells immediately in front of the advancing infantry; as the infantry progress the barrage is lifted or advanced to a line a little farther ahead, and slowly and methodically moves forward according to a definite and very carefully worked out time-table. The creeping barrage has this advantage over the ordinary covering fire in that, from the nature of its application, it tends to search out all ground over which the infantry has to pass. In both cases the object is substantially the same, i.e. to assist the advance of the infantry by preventing the enemy from manning his defences and preparing to receive the assault. It is in this way that the principles of the Regulations are carried out, and all the efforts of the component parts of the military machine working in combination are directed towards the one supreme aim of assisting the infantry to secure a decisive success. In its plain crude meaning a decisive success implies that the enemy is driven in confusion from the field with heavy losses in personnel and material, and it is not contemplated in our Regulations that such an event can be hoped for from purely defensive action. Consequently the Regulations insist that, though defensive action may at times be unavoidable, there should always be the intention in the mind of the commander to change from a defensive to an offensive attitude at the earliest suitable opportunity; this is known as the counter-stroke or counter-attack. In purely infantry tactics it is a rule that, should an enemy during the progress of an attack gain some advantage by penetrating a portion of the defences, he is to be attacked immediately and driven out by any available troops (i.e. a local counter-attack), but that the formations or units specially detailed for the delivery of the decisive counter-stroke at the psychological moment shall not be used for any less important operation than that of converting the defence into the attack.

We are told that fire alone cannot win battles; nevertheless, the accurate and *controlled* fire of well-trained infantry is of inestimable value in staving off defeat by superior numbers and thus obtaining at least a qualified success. It is not meant to imply that this is the only or principal use of fire—enough has been said earlier in this article to show that this is not so—but it is impossible to forget how, in the very early days of the European War, the extraordinarily accurate and rapid fire of the incomparable British soldier of those days was of the greatest value in keeping back the German hordes. Unprovided with everything necessary for modern war—the Expeditionary Force had less than 500 light and medium field-guns, and well under 200 machine-guns—and opposed by an enemy vastly superior in numbers and abundantly supplied with all munitions, the British infantry scored a success; not a decisive success, certainly, but a success nevertheless, and one which made possible the decisive blows of later years when the other arms were in a position to afford the support which infantry is entitled to expect in order that it may do its work.

Infantry is necessarily slow in its movements, but it possesses two outstanding attributes, viz.

the ability to cross any description of ground, to move by roads or across country, to fight in the sandy wastes of the Sahara, the enclosed and cultivated terrain of Europe, the bush of tropical Africa, or the barren and rocky hills of the North-West Frontier of India. Our infantry has fought, and no doubt will yet have to fight, in any or all of such countries, and provision is made in our training manuals whereby the soldier is taught to apply the principles of war and tactics to each and every occasion. Further, infantry, unlike other arms, can move in darkness with comparative ease over rough and difficult ground. This faculty is valuable in a deliberate attack on a prepared position, as it enables infantry to gain ground during the night with possibly less loss than would be incurred in daylight. The present Regulations, based on the experiences of the European War, only contemplate such minor and local night operations.

We have said that infantry is slow in its movements, the normal rate of march *on a road* and in column of route being only 3 miles an hour, and even this rate cannot be assured when large bodies or columns composed of all arms are involved. But, though normally slow and restricted as to distance, infantry can easily be packed on or into any form of transport available, and so cover considerable distances. To all intents and purposes this converts infantry into mounted infantry, i.e. troops who, though trained and organized as infantry, are, for purposes of locomotion, provided with extraneous aids. The thane of early Saxon days was a mounted infantryman, seeing that he rode his horse to travel and got off him to fight; the dragoon of the seventeenth century was a mounted infantryman in that in his original form he was armed, accoutred, and dressed as a foot-soldier, and used his horse only as a means of rapid movement; so also became the extra man whom it was the custom during the Thirty Years' War to mount on the crupper; so also were the infantry soldiers, British and Indian, who in the last Burmah War were mounted on country ponies; so also were the troops in South Africa in 1900 who, in many cases, on arrival in the country were given horses and told they were mounted infantry; so too, in essence, are troops in this mechanical era who are packed into buses, lorries, and other motor vehicles and transported 40 to 50 miles to the scene of action.

The whole question is one of giving added mobility to the ordinary infantry soldier. The term 'light infantry', still used in the titles of certain regiments, is in these days merely an honourable distinction dating back a century or more, and also finding its origin largely in a matter of mobility. In the days when the soldier's normal training consisted entirely in the performance of rigid and complicated drill movements, and when all fighting was done in close order and in two ranks, it was found convenient to train certain regiments to manœuvre on the battlefield in open order, i.e. with an interval of a yard or more between men. In the first instance one company in each regiment was so trained, but later whole regiments became light infantry, and still later, when the light-infantry system became universal, the title was in some instances conferred as a reward for good service in the field.

After every great war changes and modifications of the existing system become necessary. After the South African War of 1899–1902 these changes to a considerable extent followed the line of imitating the methods of the enemy of that time. The Boer farmers had used their rifles with effect at very long ranges; consequently we, in our musketry training, insisted on the necessity of a man being able to hit a bull's-eye target at 1000 yards. In drill and movement generally it was much the same; the Boers had no drill, therefore we would have none or next to none. This phase did not last long. Now, after the greatest of all wars, we hear some enthusiasts assert that they can foresee the time when all work on a battlefield which now devolves on infantry will be performed by tanks, small and large, possibly run, electrically controlled, from a safe distance in rear; also that battles will be won and campaigns ended not by the annihilation of the enemy's personnel, the capture or killing of his soldiers, but by the destruction of his mechanical fighting-machines—to all intents and purposes a mere destruction of material. If and when this takes place, will there not still be the human side—the population of the warring nations—to be reckoned with? And the infantry, shorn of mechanical aids, may yet once more come into its own as 'the arm which in the end wins battles'.

The infantry regiments of the British army are given below by the titles directed to be used for official correspondence. The numbers in brackets are the numbers of the old regiments of foot from which the present regiments were formed when the system of territorial or county distribution was adopted. Where the title of the regiment is obscure, the county of origin is also shown.

The Royal Scots (1).
The Queen's Royal Regiment (2). West Surrey.
The Buffs (3). East Kent.
The King's Own Royal Regiment (4). Lancaster.
The Northumberland Fusiliers (5).
The Royal Warwickshire Regiment (6).
The Royal Fusiliers (7). London.
The King's Regiment (8). Liverpool.
The Norfolk Regiment (9).
The Lincolnshire Regiment (10).

The Devonshire Regiment (11).
The Suffolk Regiment (12).
The Somerset Light Infantry (13).
The West Yorkshire Regiment (14).
The East Yorkshire Regiment (15).
The Bedfordshire and Hertfordshire Regiment (16).
The Leicestershire Regiment (17).
The Royal Irish Regiment (18).
The Green Howards (19). Yorkshire.
The Lancashire Fusiliers (20).
The Royal Scots Fusiliers (21).
The Cheshire Regiment (22).
The Royal Welch Fusiliers (23).
The South Wales Borderers (24).
The King's Own Scottish Borderers (25).
The Cameronians (26, 90). Lowlands of Scotland.
The Royal Inniskilling Fusiliers (27, 108).
The Gloucestershire Regiment (28, 61).
The Worcestershire Regiment (29, 36).
The East Lancashire Regiment (30, 59).
The East Surrey Regiment (31, 70).
The Duke of Cornwall's Light Infantry (32, 46).
The Duke of Wellington's Regiment (33, 76). West Riding.
The Border Regiment (34, 35).
The Royal Sussex Regiment (35, 107).
The Hampshire Regiment (37, 67).
The South Staffordshire Regiment (38, 80).
The Dorsetshire Regiment (39, 54).
The Prince of Wales's Volunteers (40, 82). Lancashire.
The Welch Regiment (41, 69).
The Black Watch (42, 73). Highlands.
The Oxfordshire and Buckinghamshire Light Infantry (43, 52).
The Essex Regiment (44, 56).
The Sherwood Foresters (45, 95). Notts and Derby.
The Loyal Regiment (47, 81). Lancashire.
The Northamptonshire Regiment (48, 58).
The Royal Berkshire Regiment (49, 66).
The Queen's Own Royal West Kent Regiment (50, 97).
The King's Own Yorkshire Light Infantry (51, 105).
The King's Shropshire Light Infantry (53, 85).
The Middlesex Regiment (57, 77).
The King's Royal Rifle Corps (60).
The Wiltshire Regiment (62, 99).
The Manchester Regiment (63, 96).
The North Staffordshire Regiment (64, 98).
The York and Lancaster Regiment (65, 84).
The Durham Light Infantry (68, 106).
The Highland Light Infantry (71, 74).
The Seaforth Highlanders (72, 78).
The Gordon Highlanders (75, 92).
The Cameron Highlanders (79).
The Royal Ulster Rifles (83, 86).
The Royal Irish Fusiliers (87, 89).
The Connaught Rangers (88, 94).
The Argyll and Sutherland Highlanders (91, 93).
The Leinster Regiment (100, 109).
The Royal Munster Fusiliers (101, 104).
The Royal Dublin Fusiliers (102, 103).
The Rifle Brigade.

For the organization of infantry, see *Army*.

Infant Schools. See *Kindergarten*.

Infection is the process by which living, virulent microbes capable of causing disease gain access to some place in the body where they can grow and produce poisonous substances (toxins) that act upon the tissues of the body and so produce the symptoms of the disease in question. A specific infection is due to one particular kind of organism that causes a definite disease, as, for example, tetanus, produced by a special bacillus. Non-specific infections are those which might be due to a variety of organisms. Thus many different bacteria may give rise to abscesses. The infection may be local, the bacteria developing in or near the place where the bacteria were introduced; or it may be general, the organisms growing and multiplying in the blood-stream and affecting the whole body. But local infections usually become general.

Infectious Diseases. The history of infectious diseases in this country, as far back as reliable facts are available, indicates that almost all of them have diminished in *severity*, and that the majority have diminished in *prevalence*. The progress of disease has been capable of accurate study since 1855, when registration of the cause of death by medical practitioners was made compulsory in Scotland; more recently, as regards infectious diseases especially, a study of their actual incidence in the population has been made possible since the passing of the Notification Act, which has been in operation over the whole of Scotland since 1897, and in England since 1899. From the data thus recorded can be calculated (*a*) death-rates from various diseases among the population, (*b*) attack rates, indicating the prevalence of individual affections in the whole country or in its several parts, down to such local inquiries as the distribution of disease in town or country, its relationship to age, mode of life, climatic conditions, type of house, occupation, school, &c. Out of this has risen the special science of epidemiology, whose function is ' to institute a rigid examination into the causes and conditions which influence the origin, propagation, mitigation, prevention, and treatment of epidemic diseases '.

As an illustration of the behaviour of infectious diseases since 1855, the table on the following page may be quoted. The mean death-rates in decennial periods from 1855 to 1919 are given as rates per 100,000 of the population.

It will be observed that the death-rates from the principal infectious diseases, with the exception of pneumonia, have undergone a marked and significant decline. Cancer has been introduced into the table as it is the most outstanding example of a disease which has been increasing in fatality in recent years.

While a table such as this gives a rough idea of the alterations in severity of the major infections, statistical studies of the behaviour of individual diseases show that many of them are subject to periodic waves of increase and decline in their incidence as well as to seasonal variation. It is true of most of them that they have a seasonal curve within a longer ' epidemic ' wave, which may be spread over several years.

These features of infectious disease are best illustrated by reference to individual affections.

Scarlet Fever has greatly diminished in virulence since the middle of last century. In 1866–70 the mortality rate among patients in hospital was 20 per cent, a figure which has fallen to 6 per cent in 1891–4, and to about 3 per cent at the present day. This affection is, however, about as prevalent now as then, though much

SCOTLAND: DEATH-RATES PER 100,000 FROM CERTAIN INFECTIOUS DISEASES, 1855–1919

YEAR.	Smallpox.	Measles.	Scarlet Fever.	Diphtheria and Croup.	Whooping-cough.	All Diarrhœal Diseases.	Typhus Fever.	Enteric Fever.	Syphilis.	Cancer.	Tubercle (all forms).	Phthisis alone.	Pneumonia.	Bronchitis.
Mean.														
1855–60 ..	35	43	98	44	72	106	91		3	34	360	255	75	126
1861–70 ..	18	42	96	68	70	95	65	42	5	42	379	268	71	210
1871–80 ..	19	36	79	55	63	90	15	40	6	49	354	244	90	252
1881–90 ..	0	39	29	43	61	72	3	23	6	59	278	202	109	201
1891–1900..	1	47	19	29	52	84	1	18	5	74	239	171	130	165
1901–10 ..	1	34	9	18	44	64	0	9	5	93	211	139	145	116
1919	0	18	5	15	32	32	0	2	4	116	129	88	227	119

milder in form. In this country the seasonal incidence is at its maximum during the autumn months. Apart from this seasonal variation, it has, at least in large cities, a general wave-like periodicity in incidence of from ten to twelve years. For instance, since 1899 the *attack rate* in Scotland rapidly fell from nearly 190 per million of the population to under 45 in 1905, after which it immediately rose to its former level, falling again to the 1905 level in 1918, since when its incidence has again been rising. This wave of infectivity between 1905 and 1918 has not been accompanied by any very appreciable increase in severity, a clear indication that the factors which determine infectivity do not necessarily also affect the virulence of a disease.

Diphtheria is an example of an infectious disease which has tended rather to increase since definite records of notification began, a feature largely due to the development since 1910 of laboratory facilities, enabling mild cases to be detected. On the other hand, there has been a rapid diminution in the fatality of this disease, especially since the introduction of antitoxin treatment. In the early 'nineties one-third of the patients died, a figure which has now fallen to well below one-tenth. Here, again, there is evidence of a wave-like prevalence of longer duration than in the case of scarlet fever, although the yearly seasonal variations of these diseases correspond fairly closely. Statistics indicate that this disease prevails more in town than in country areas.

Enteric Fever is very obedient to sanitary progress, especially as regards purity of water-supplies and food, and communal cleanliness. Its prevalence in recent years has become so low that the death-rate has almost declined to vanishing-point, as shown in the table. The death-rate for 1919 is only 2, as compared with 42 during the decennium 1861–70. Although very much less prevalent, its case-mortality has not greatly declined, about 14 per cent of the cases being fatal.

Typhus Fever, which has now been shown to be mainly a lice-borne infection, has greatly declined in prevalence during the past fifty years. It still occasionally occurs in the winter in sporadic form in large cities. It has proved very amenable to sanitation, and is not likely to recur in epidemic form unless some increase in infectivity takes place in the organism itself.

Smallpox has also been conspicuous by its absence since the beginning of the century. Waves of epidemic prevalence occurred in 1871–4, and again in 1900–2. Smallpox is showing a certain degree of restlessness, which may be a prelude to a period of heightened infectivity.

Measles and *Whooping-cough*, though not generally notifiable diseases, are yet very prevalent. Regarded as 'minor' infections, they are yet among the most deadly diseases in respect of numbers attacked and mortality. The measles curve has two seasonal peaks, a higher bi-annual one in late winter or early spring, and a lower one in June, when the prevalence occurs during successive years. In addition, in large urban populations there tends to be an excessive wave of prevalence every two years. Its death-rate has shown little diminution in recent years. Whooping-cough is somewhat less prevalent than measles, but is even more fatal, although considerable reduction in its death-rate falls to be noted. It prevails most in large industrial centres, and at one time had a death-rate of 70 per 100,000, which in more recent years has been reduced to less than half that rate. This disease also, like measles, has a definite periodicity, with a maximum occurring every second year.

Tuberculosis has steadily declined since 1870 throughout Great Britain. In Scotland the death-rate during the period 1861–70 was 379 per 100,000, pulmonary tuberculosis being responsible for a rate of 268, and other forms for 111. By the year 1919 the general tuberculosis rate had fallen to 129—a reduction to 88 in the case of consumption, and to 41 in the case of other forms of tuberculosis. This serious cause of death has shown a marked progressive reduction during the past fifty years, especially so since the beginning of this century. It still, however, occupies a prominent place in mortality tables, 40,000 to 50,000 deaths occurring yearly from pulmonary tuberculosis alone throughout the country.

Influenza, Pneumonia, &c.—The death-rate from influenza, &c., is not given in the summary total already referred to, as until the marked outbreak of these diseases in 1918 influenza was not classified as a cause of death by the Registrar-General when any other cause was associated with it. The recurrence, however, of influenza and pneumonia in epidemic form in the early spring of the following year emphasized the excessive periodical fatality due to these causes, which thereafter led the Board of Health to add pneumonia, in its acute or primary forms, to the list of notifiable diseases.

During the prevalence of influenza and its complications in 1918 and 1919 the number of deaths recorded in Scotland alone was 17,575, which is much in excess of the deaths registered from other important outbreaks of infectious disease, such as the following: scarlet fever (1874–5), 11,041; measles (1893), 3639; diphtheria (1863), 3615.

The age incidence of deaths indicated that it was much more severe at the ages twenty-five to thirty-five than at any other period of life, a feature in distinct contrast to the general death-rate, which at the same age-period is comparatively light.

Nearly 84 per cent of the cases of influenza were associated with other causes of death, the most prevalent cause being pneumonia, which constituted nearly 64 per cent, or 11,236, of the cases.

The above account of the salient statistical features of the principal infectious diseases may be concluded with a list of the notifiable diseases now dealt with by Local Authorities.

Compulsorily notifiable: typhus, enteric, and typhoid fever; continued and puerperal fever; smallpox; scarlet fever; diphtheria; erysipelas; cholera; cerebro-spinal fever; ophthalmia neonatorum; trachoma; acute encephalitis lethargica; polio-encephalitis; acute poliomyelitis; acute primary pneumonia; acute influenzal pneumonia; malaria; dysentery; relapsing fever; trench fever; pulmonary and non-pulmonary tuberculosis. Voluntarily notifiable: measles, whooping-cough, chicken-pox, &c.

Infeft′ment, in Scots law, a term used to denote the act of giving symbolical possession of heritable property, the legal evidence of which used to be an instrument of sasine. The instrument of sasine is now obsolete; infeftment is effected by the grantee under a charter or conveyance recording it in the Register of Sasines.

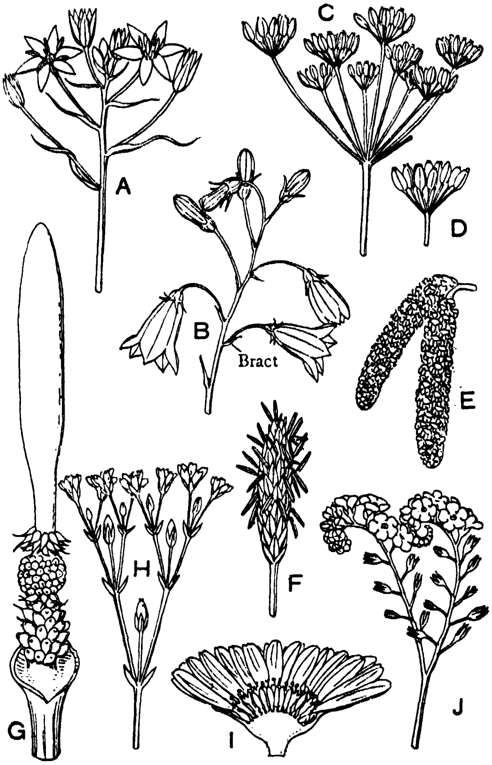
Infernal-machine, the expression formerly used to describe an explosive bomb used for any overt act of destruction. In these days the word bomb is more generally used in this connection. The literal meaning of the expression is a bomb intended to be exploded by some mechanical means, and, in the original form, these were the means always adopted. The bomb, filled with the necessary amount of explosive, was provided with a clockwork mechanism which, when wound up and set going, would after a certain interval release a striker arranged to act on a cap of fulminating compound, causing the explosion to follow. Such machines were not always reliable, and the classes of criminals given to their use have on occasions themselves suffered from the effects of premature explosions. It would seem that in modern times chemical means of causing the explosion have entirely ousted the original mechanical contrivances.

In′finite and **Infinites′imal,** in mathematics. A variable quantity which increases without limit (q.v.) is *infinite*; a variable quantity the limit of which is zero is *infinitesimal.* ‘ Infinite ’ is also used in a slightly different sense in such statements as ‘ the number of positive integers is infinite ’, or ‘ the number of terms of the exponential series is infinite ’. Here the meaning is that, if we select any number we please, there are more positive integers, or more terms of the exponential series, than the selected number. ‘ Infinitesimal ’ is sometimes used in the sense of ‘ exceeding small ’, or ‘ so small that, for the calculation in hand, its square may be neglected ’. See *Calculus, The Infinitesimal*; *Limit*; *Number*; *Geometry.*

Inflamma′tion was defined by the late Sir Burdon Sanderson as “ the succession of changes which occur in a living tissue when it is injured, providing the injury is not of such a degree as at once to destroy its structure and vitality ”. The most obvious phenomena are pain, swelling of the affected part, perceptible increase of heat in the patient, and redness beyond the natural degree, often followed by febrile symptoms. Inflammation, when not excessive, is a beneficent process which serves the purpose of attacking noxious microbes of disease and eliminating them from the system. Inflammations may arise from external injuries, or may be brought on by infective organisms, sudden changes of temperature, &c. The three commonly-described terminations of inflammation are *resolution*, *suppuration*, and *mortification* or *sloughing*. *Resolution* is that recovery from the disorder which is effected without the intervention of any disorganizing process, and when the vessels return to their normal condition on the exciting cause of the disorder being withdrawn, and this is the most favourable mode of termination. If inflammation cannot be resolved, it must go on to *suppuration*, when the skin must either be cut open or break of itself, and there is an escape of a yellow creamlike fluid, after which the symptoms rapidly abate. The tendency to suppuration is marked by the pain becoming full and throbbing, while the pulse becomes more full without being less frequent. *Mortification* is accompanied by the sudden cessation of pain, and there is the actual death of the part affected. When the circumstances are favourable, this dead part sloughs off by a vital process known as *ulceration*, and the cavity gradually fills up and heals. In many cases inflammation may rather be considered as a salutary process than as a disease, for it frequently prevents evils which would occasion either serious or fatal consequences. The most important remedies in cases of severe inflammation are hot fomentations, blisters, and the warm bath, combined with low diet and perfect quietude. As to inflammation of the intestines, see *Enteritis*; of the eye, see *Iritis*; of the bowels, see *Peritonitis*; of the brain, see *Meningitis*; of the lungs, see *Pneumonia*.

Inflection (Lat. *inflexio*, a bending), in grammar, the changes in form which words undergo in consequence of standing in certain relations to other words in a sentence. These changes occur for the most part at the end of words, and the inflectional elements were all probably at first separate vocables. To inflection belong those changes which comprise cases, numbers, persons, tenses, &c. In some languages we have positive proof of inflections being formed of words originally distinct. Thus Fr. *aimerai*, I shall love, the future of *aimer*, to love, is, literally and historically, I have to love, and is compounded of *aimer*, to love, and *ai*, I have, the first person present indicative of *avoir*. The same is the case in Italian and Spanish. The loss of inflections is a common feature of the Romance tongues as compared with the Latin, on which they are based, and is also a feature of English as compared with Old-English. The result in both cases is much less freedom in the arrangement of words, but this is counterbalanced by greater perspicuity.—Cf. M. Bréal, *Essai de Sémantique*.

Inflores'cence, in botany, the mode of flowering of any species of plant, that is, the manner in which its blossoms are grouped together, and in some cases in which they successively open. The principal forms of inflorescence are the *amentum*, *corymb*, *cyme*, *head* or *capitulum*, *fascicle*, *raceme*, *panicle*, *thyrsus*, *spike*, *whorl*; *centrifugal* and *centripetal* are also terms applied to two types of inflorescence.



Forms of Inflorescence

A, Corymb. B, Raceme. C, Umbel (compound). D, Umbel (simple). E, Pendulous raceme, catkin. F, Spike. G, Spadix. H, Dichotomous cyme. I, Head. J, Scorpioid cyme.

Influenza is an acute infective disease presenting varied clinical features, but showing a special tendency to affect the respiratory tract. It appears in world-wide epidemics at irregular intervals, and spreads with great rapidity.

There is some difference of opinion as to the causal germ; but the generally accepted view is that the Bacillus Influenzæ is the primary infective agent, and that other germs are associated with it as secondary invaders.

The incubation period is short, usually two days, but it may vary from a few hours to five days, and the rapid spread of the disease in times of epidemics is due to this short incubation period and to the wide-spread susceptibility of the population. In the 1918–9 epidemic, men who had been gassed during the European War were more susceptible, and it is probable that people suffering from catarrhal condition of the naso-pharynx and the respiratory tract are likewise more susceptible.

Four different clinical types are recognized:

(1) *Simple Febrile Type.*—The onset is abrupt, beginning with severe pain in the back, head, and limbs, and with a feeling of chilliness and general lassitude. The temperature rises rapidly and the tongue is thickly furred. Sore throat is complained of, and there is frequently a dry, irritating cough. Many patients sleep heavily and desire to remain undisturbed, while others are restless and sleepless. The fever disappears in three or four days, and the patient is left weak and listless for some time afterwards. The simple febrile form may, however, develop into one of the more severe types, and even the slightest case should be watched at first with care.

(2) *The Severe Respiratory Type.*—The disease in this type begins with the same symptoms of fever, pain, and prostration, but the cough and respiratory distress soon become more marked. Pain in the front of the chest is complained of, while the cough is very severe and irritating, becoming paroxysmal and causing considerable exhaustion. Bronchitis may be present, and the condition may spread to the smaller tubes and cause broncho-pneumonia. In this type of influenza the early appearance of cyanosis (blueness) of the face is a very serious sign, and it has been observed that when cyanosis appeared as early as the second day, the result was nearly always the death of the patient. The acute symptoms in this type of influenza last from two to three weeks, and when recovery takes place, it may be slow with a long convalescence. Occasionally very severe cases are seen in which death occurs within thirty hours of the onset.

(3) *The Abdominal Type.*—In this form of the disease, as well as the head and back pain with prostration there is severe abdominal pain with vomiting and occasionally diarrhœa. There is complete loss of appetite, and a markedly furred tongue with fœtid breath. In the early stages these latter symptoms may be so severe that the condition may be confused with abdominal trouble requiring surgical interference.

(4) *The Cerebral or Nervous Type.*—In this type the headache, pain in the back, and prostration are the prominent symptoms, with persistent insomnia and at times delirium. Convalescence is often retarded by mental exhaustion, and neuralgia in various forms may appear. When unchecked, this mental depression may become melancholic.

The chief complications which may arise in influenza are: deafness, with disease of the middle ear; pleurisy; dilation of the heart and other heart disorders; epistaxis and, less frequently, hæmorrhage from the lung, bowel, or bladder; nephritis; parotitis; while various rashes may be seen. An attack of influenza may light up latent pulmonary tuberculosis, or it may be the onset of that disease.

The severity of influenza varies with the different epidemics, and the death-rate was much higher in the 1918–9 epidemic than in the 1921–2 outbreak. Relapses and re-infection are common, as the immunity from an attack is short.

In the treatment complete rest in bed in all cases is to be advised, and the patient should not get up for at least three days after the temperature is normal and the chest signs have disappeared. Wherever possible, the patient should be isolated and suitable nursing provided, while the diet should be restricted to fluids. Sleep should be obtained, if possible, in all restless cases, though opium is to be used with great care wherever chest symptoms are prominent. Warmth to the chest in some form is indicated to relieve the tightness and discomfort, and many drugs are used for the relief of the back pains with varying results.

Vaccines are of use as a preventive measure in epidemics, and these have considerable effect in lessening outbreaks in large communities, as schools, colleges, and institutions. Further prevention should be aimed at during epidemics by the use of disinfectant gargles and nose-washes.

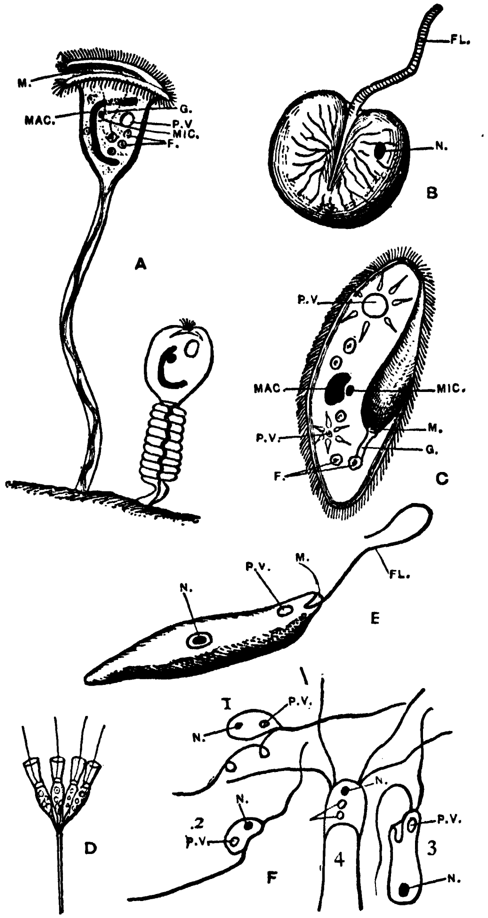
Information (*informare*, to sketch, to give shape to, to describe, represent), in English law, a term used in several senses. In criminal law, an information, filed by the Attorney-General, is a substitute for an ordinary indictment, and is resorted to only in such cases of misdemeanour as tend to disturb the peace or the government; e.g. libels on judges, magistrates, or public officers, or bribery at elections. An information in Chancery is a suit on behalf of the Crown as to any misapplication of a public charity, or on behalf of an idiot or lunatic. An information in the Exchequer is to receive money due to the Crown, or to receive damages for an intrusion upon Crown property. The term also denotes a written statement made on oath before a justice of the peace previous to the issuing of a summons or complaint against a person.

Information, Ministry of, a department of the British Government, established during the European War for the purpose of acquainting the world with British war-aims and counteracting the enemy's efforts in neutral countries. At first the work was under the control of the

Foreign Office, but in 1916 a special department was set up. In 1918 the department became a ministry, and Lord Beaverbrook was appointed Minister of Information. The ministry ceased to exist after the armistice, i.e. towards the end of 1918.

Informer, the person who prosecutes those who have infringed any law or penal statute. To encourage the apprehending of certain felons, guilty of offences not so much criminal as bordering on criminality, many English statutes, from 1692 and downwards, granted rewards to such as should prosecute to conviction; and this practice has been resorted to frequently in modern statutes. In Scotland the informer is a party who sets the Lord Advocate in motion in criminal prosecutions. The early legislation on this point gave rise to the most flagrant abuses, and police officers made a trade of seducing poor, ignorant persons to crimes, especially the issuing of counterfeit money, to gain the reward. The informer, no doubt, advances the cause of law and justice and serves the interests of society, but he is nevertheless a despised and hated creature. More often than not he acts as informer for the pecuniary reward offered and not for the promotion of the welfare of society. Informers or delators existed in Ancient Greece, where they were known as Sycophantes, and in Imperial Rome, where they flourished exceedingly. Political informers were numerous in Russia from the reign of Peter the Great to 1917.

Infusoria, a large group of minute, mostly microscopic, animals, so named from being frequently developed in organic infusions, provisionally regarded as the highest subdivision of the Protozoa. They are provided with a mouth, except in certain parasitic forms, are destitute of pseudopodia, but are furnished with vibratile cilia during part or all of their existence. Most are free-swimming, but some form colonies by budding, and are fixed to a solid object in their adult condition. The body consists of an outer transparent cuticle, a layer of firm protoplasm called the cortical layer or ectosarc, and a central mass of semiliquid protoplasm (endosarc). Contractions of the body are effected by fibrils in the ectosarc. The cilia are not only organs of locomotion, but form currents by which food is carried into the mouth. A large nucleus (meganucleus) and a small one (micronucleus) are present, the latter playing an important part in reproduction, which is typically by fission. In many cases temporary or permanent fusion (conjugation) takes place, and this is followed by active fission. Under unfavourable conditions, infusoria may pass into a resting or encysted stage, the body contracting into a rounded mass and forming a firm investment. They are divided into two groups, Ciliata and Suctoria. The former may be free-swimming, as the slipper animalcule (Paramœcium), or fixed, as in the case of the bell animalcule (Vorticella). The Suctoria are parasitic, and suck the juices of other Protozoa or of Crustacea by means of peculiar tentacles.



Infusoria

A, Bell animalcule (Vorticella), extended and retracted. B, Noctiluca. C, Slipper animalcule (Paramœcium). D, Codonocladium. E, Euglena. F, Monads: 1 and 2, springing monad (Heteromita); 3, Chilomonas; 4, Hexamita. F, Food. FL, Flagellum. G, Gullet. M, Mouth. MAC, Macronucleus. MIC, Micronucleus. N, Nucleus. PV, Pulsating vacuole.

Inge, William Ralph, British theologian, born 6th June, 1860, at Crayke, Yorkshire. Educated at Eton and at King's College, Cambridge, where he had a brilliant career, he was a master at Eton from 1884 to 1888, and from 1889 to 1904 Fellow and tutor of Hertford College, Oxford.

He was vicar of All Saints', Ennismore Gardens, London, from 1905 to 1907, when he was appointed Lady Margaret professor of divinity at Cambridge. In 1911 he came again to London as Dean of St. Paul's Cathedral, where he distinguished himself by his views and utterances on social questions. His works include: *Society in Rome under the Cæsars* (1886), *Christian Mysticism* (1899), *Truth and Falsehood in Religion* (1906), *Personal Idealism and Mysticism* (1907), *Speculum Animæ* (1911), *The Church and the Age* (1912), and *Outspoken Essays* (1919).

Ingelow (in′je-lō), Jean, English poet, was born in 1820, died in 1897. In 1863 she published a volume of poems, which ran through fourteen editions in five years, and her popularity subsequently increased both through her prose writings and her poetry. In prose she wrote novels and tales for children, including *Mopsa the Fairy*, *Studies for Stories*, *Off the Skelligs*, *Sarah de Berenger*, and *Don John.*

Ingolstadt (ing′ol-ståt), a fortified town of Bavaria, on the Danube, 35 miles s.w. of Ratisbon. It has an old and a new castle, a fine old Gothic church, and a Jesuit college; before the end of the European War there was a considerable manufacture of ordnance and gunpowder. Ingolstadt had a university of some celebrity, founded in 1472, but in 1800 it was removed to Landshut and in 1826 to Munich. Pop. (1919), 26,103.

Ingot (ing′got), a small bar of metal made of a certain form and size by casting it in moulds. The term is chiefly applied to the small masses or bars of gold and silver intended either for coining or exportation to foreign countries.

Ingres (aŋ-gr), Jean Dominique Auguste, French painter, born in 1780 at Montauban, died in Paris 1867. He first studied under David, and in 1806 went to Rome, where he resided for fifteen years. After a further residence of four years in Florence he returned to Paris and opened an atelier for students, his fame being by this time fully established. In 1834 he succeeded Horace Vernet as director of the French Academy at Rome. In the same year he was nominated Chevalier, and in 1845 Commander of the Legion of Honour. In 1855 he received the grand medal of honour at the International Exhibition, and in 1862 he was made a Senator and member of the Council of Public Instruction. Ingres was the recognized leader of the Classic as opposed to the Romantic painters of his time. A passionate admirer of Raphael and Classical antiquity, as a draughtsman and designer he is in the front rank, though his colour is dull and insipid. Among his best-known works are *Bonaparte as First Consul*, *Œdipus and the Sphinx*, *Apotheosis of Homer*, *Birth of Venus*, *Virgil Reading his Æneid to Augustus*, *The Source*, *An Odalisque*, and a remarkable series of portraits, especially of women. His influence on modern painting has been considerable. He is best represented in the Louvre, but can also be seen in the National and Tate Galleries.

Inhabited House Duty, in Great Britain a tax on inhabited 'houses' worth £20 and upwards annual value. The rates charged per £1 are, for shops, inns, and farm-houses 2*d.* up to £40, thereafter 4*d.* up to £60, and 6*d.* above £60, while for other houses the rates within the same limits of value are respectively 3*d.*, 6*d.*, and 9*d.* A house occupied only by a caretaker is exempt.

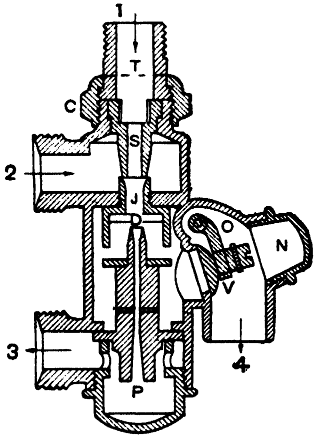
Inhaler, an apparatus for inhaling vapours and volatile substances, as steam, vapour of chloroform, iodine, &c. A commonly used type of inhaler consists of a tin can containing a small spirit-lamp, and above this a small kettle for hot water, the steam of which is driven out with some force when the apparatus is used. Attached to the can is a receptacle for receiving a small phial containing the substance whose vapour is to be inhaled, this being drawn off and forced through the funnel by the steam.

Inhambane (in-yåm-bä′ne), a Portuguese town and seaport on the east coast of S. Mozambique or Portuguese East Africa. Pop. 4000.—The coastal district has an area of about 33,000 sq. miles, and a population of 750,000.

Inhibition, in Scots law, is a writ issued to prohibit a person from burdening or alienating his real estate till the debt of the creditor is paid. In ecclesiastical law it is an order of a bishop prohibiting a clergyman from discharging any duty of his office.

In′ia, a genus of Cetacea belonging to the dolphin family, containing only one known species, *I. geoffroyensis*, remarkable for the distance at which it is found from the sea, frequenting the remote tributaries of the River Amazon, and even some of the elevated lakes of Peru, particularly Titicaca. It has bristly hairs on its snout, and is from 7 to 12 or 14 feet long.

Injector, a device in which the kinetic energy of steam issuing from a jet is used to set another fluid in motion. One of its main uses is to feed water into a boiler. In the type of injector shown in the illustration the steam enters through the top nozzle, and its first action is to exhaust any air present. Once the suction of water is established, through the condensation of the steam, the mixture of feed water and condensing steam passes through the bottom jet with a considerable velocity. This jet has a gradually enlarged passage to its end in order to transform part of the kinetic energy of the moving water to pressure energy, and the pressure produced is sufficient to enable the steam to open the clack valve and flow into the boiler. The major part of the heat contents of the steam used is returned to the boiler in the feed water.



Penberthy Injector

S, Steam jet. P, Plug. O, Overflow hinge. J, Suction jet. T, Tail pipe. V, Overflow valve. D, Delivery jet. C, Coupling nut. N, Overflow cap.
1, Steam inlet. 2, Water inlet. 3, To boiler. 4, Overflow.

Injunction, in English law, most commonly a prohibitory writ, issuing from any of the divisions of the High Court of Justice, restraining a person from doing some act which appears to be against equity, and the commission of which is not punishable by criminal law. It is either *provisional*, until the coming in of the defendant's answer, or *perpetual*, that is, perpetually restraining the defendant from the commission of an act contrary to equity. Disobedience to an injunction constitutes contempt of court, and is punishable accordingly. In Scots law the corresponding term to 'prohibitory' or 'preventive' injunction is *interdict*. Very occasionally the court will issue a 'mandatory' injunction, enjoining that something be done.

Ink-bag, or **Ink-sac**, a bladder-shaped sac found in some dibranchiate cephalopods, as the calamaries or squids, and containing a black viscid fluid resembling ink. This fluid is to some extent used for drawing, under the name of sepia.

Inkermann, a town of Russia, government of Taurida, in the Crimea, at the head of Sebastopol harbour. It is famous for the signal victory of the Allies over the Russians in the Crimean War, 5th Nov., 1854.

Inks are materials used for producing permanent records on paper and other substances. They are either fluid, as in the case of writing-inks, or in the form of pastes when used for printing. The earliest use of a liquid which can be described as ink is found on papyrus documents dating from 2500 B.C. The basis of the ink consisted of charcoal ground up with gum solution, oil, or varnish. At a later date the black secretion of the cuttle-fish or sepia was used by the Romans, but it was not until the eleventh century that inks of the iron-gall type, which form the basis of most writing-inks of the present time, were used. The transition from carbon and sepia inks to those of the iron-gall type was a very gradual one, and it is noticeable that manuscripts in which the former types of ink were used are as a rule more legible than those written with the latter kind. This is partly to be ascribed to the lack of knowledge regarding the correct proportions of the ingredients used in its preparation. The following are the chief types of inks at present used, together with their composition and characteristics.

Blue-black and *black inks* form the most important class of writing-inks. They consist essentially of a decoction of gall-nuts or other tannin-yielding substances mixed with an iron salt such as copperas (ferrous sulphate). Writing with such a fluid is of a pale bluish-grey colour, and gradually turns black on exposure to the air, due to the oxidation of the soluble bluish substance to an insoluble black compound which cannot be removed from the paper by washing. In order to obviate the initial paleness of the writing, provisional colouring-matters such as logwood extract or aniline dyes are added to the ink. The following formula gives a typical ink of this nature: 1 lb. of ground Chinese or Aleppo galls is boiled with 3 pints of water, and the extract treated with 3 oz. of copperas and the same quantity of gum arabic dissolved in 1 pint of water; soluble indigo is then added as a provisional colouring-matter, and also a small quantity of phenol (carbolic acid) to prevent fermentation. After standing for some days the ink is decanted and is ready for use. Gallic acid and logwood extracts are also largely used in the preparation of blue-black and black inks. *Red inks*. Ordinary red ink consists of a 1 per cent solution of eosine in water, together with a small quantity of an antiseptic to prevent the formation of mould. Other aniline dyes, such as cotton scarlet, ponceau scarlet, &c., are also suitable. Before the discovery of aniline dyes red inks were prepared from cochineal and from Brazil wood, but these inks are more fugitive to light than those made from synthetic dye-stuffs. *Green inks* are prepared from aniline dyes such as malachite green, or from a mixture of soluble indigo and a yellow dye. *Violet inks* are made from the synthetic dye-stuff methyl violet, 1 part being dissolved in 300 parts of water. *Blue inks* consist of a solution of soluble indigo, or of some other blue dye which possesses a sufficient degree of fastness to light. *Copying-inks* are prepared by the addition of sugar, glycerine, gum, or dextrine to an ordinary writing-ink. These materials prevent the complete penetration of the ink into the paper. On placing a damp sheet of tissue-paper over the writing and submitting it to pressure, part of the ink is transferred on to the copying-sheet. *Marking-inks.* The juice of certain plants such as the ink plant, cashew nut, and various forms of sumach can be used for the indelible marking of linen, but the majority of modern marking-inks contain a silver salt as a basis. A satisfactory recipe is as follows: 2 parts of silver nitrate are dissolved in 4 parts of water; a strong solution of ammonia is added until the precipitate first formed just redissolves; 1 part of gum is then added. The ink is used with a quill pen, and rendered permanent by exposure to light or by passing a moderately hot iron over the writing. The black characters thus formed consist of metallic silver, and are not removed by washing. *Rubber-stamp inks* are made by dissolving aniline dyes of various shades in a mixture of water and glycerine, the latter preventing the ink from drying on the stamping-pad. *Indian* or *Chinese ink* is of extreme antiquity, and is still largely used in the East for writing purposes, and also by artists for black-and-white work. It consists essentially of finely-divided carbon suspended in a solution of gum, glue, or varnish. The finest variety is prepared from the soot formed when sesame oil or tung oil is burned with an insufficient supply of air. The soot is collected, thoroughly mixed with glue, moulded into sticks, and dried. A good quality Indian ink should give a uniform liquid free from coarse particles or flakes when rubbed with water. *Printer's inks* consist of pigments ground up in a mill with boiled linseed oil, resin, and soap, the latter facilitating the separation of the paper from the type. The proportions and nature of the ingredients used vary according to the nature of the work, an ink suitable for printing a newspaper in a high-speed rotary press being quite unsuitable as a lithographic ink. For black printing-inks lamp-black is used as a pigment, a small quantity of indigo being added to improve the shade. For coloured inks, vermilion, ultramarine, chrome green, chrome yellow, burnt ochre, lead white, and various other pigments are used, and also certain aniline dyes which are fast to light. *Secret* or *invisible inks* are solutions of various substances which are used on paper in the same manner as ordinary inks. Such writing is invisible until heated, or treated with the appropriate reagent. Thus writing in a dilute solution of cobalt chloride is colourless, but on heating the paper the characters appear in blue, fading again on exposure to the air. Milk, lemon juice, a solution of alum, &c., can also be used as secret inks, the writing being readily revealed by the application of a hot iron, the ink charring at a lower temperature than the paper. Other secret inks depend for their development on a definite reaction between the ink and the developer, which gives rise to a coloured substance. Thus writing in starch can be revealed by means of iodine, and sugar of lead by sulphuretted hydrogen. During the European War secret inks were largely used by spies.—BIBLIOGRAPHY: S. Lehner, *Ink Manufacture*; C. A. Mitchell and T. C. Hepworth, *Inks: their Composition and Manufacture*; Sir E. Thorpe, *Dictionary of Applied Chemistry.*

Inlaying is the art of inserting any piece of hard material into the surface of a different hard material, or into the surface of a piece of the same material, differently coloured, so as to form a decorative pattern or design. There are several varieties of inlaid work, the chief of which are *wood*, *ivory*, or *shell*; *marble* or *stone*; and *metal.*

There are two methods of carrying out *wood inlay* or *marquetry* (from the Fr. *marqueterie*): (*a*) the ancient method of cutting shallow hollows in a solid base of wood, according to a prearranged design, and filling up the hollows with pieces of natural or stained wood, shell, or other material. (*b*) The more modern method of cutting the same design on several panels of thin wood of different colours, placed one on top of the other, and subsequently fitting the pieces cut out of a panel of one colour into the space left in a panel of another colour, finally cementing the inlaid veneer thus obtained to the piece of furniture for which it has been planned.

Some of the chief veneers used in marquetry are satin-wood, tulip-wood, rose-wood, pear tree, Thuya burr, and ebony. Holly, stained black, is a substitute for ebony.

Early examples (eighth and tenth centuries B.C.) of Assyrian and Egyptian inlaid patterns of metal and ivory on wood are to be seen in the Louvre and the British Museum. The art of inlay or intarsia flourished in Italy in the fifteenth and sixteenth centuries. Dutch marquetry of the late sixteenth and early seventeenth centuries is famous. Wood inlay of good quality was produced in England in the sixteenth century. Examples of inlaid furniture may be seen at South Kensington Museum, London. The Japanese excel in inlaying polished wood with carved mother-of-pearl, tortoise-shell, stained ivory, and gold. Boulle or Buhl work was invented in Paris, 1672, by André Charles Boulle. It consists of wood or tortoise-shell richly inlaid with brass.

Marble or *stone inlay* is a decoration more suitable for covering large surfaces. Examples of marble *mosaics* are to be seen at the Geological Museum, Jermyn Street, London. A pure example of marble inlay is to be seen at the Taj Mahal, Agra, India.

Metal inlay. In Niello work, fine lines graved in metal are filled in with a dark metallic amalgam composed of silver, copper, lead, and sulphur.

Many examples of *damascene* work, originated by the goldsmiths of Damascus, and carried on to the present day in Spain and Persia, are to be found in India and Japan. It is the art of encrusting gold or silver wire on iron, steel, or bronze. In India it is known as Kuft work. Damascening in silver is known as Bidri (from Bider in the Nizam's dominion, India). On a metallic ground, blackened by a solution of sal ammoniac, saltpetre, and blue vitriol the required pattern is graved; the graven lines are then inlaid with silver.—BIBLIOGRAPHY: F. Hamilton Jackson, *Intarsia and Marquetry*; Charles J. Lock, *Marquetry.*

Inn, a river of Europe which issues from a lake in Switzerland at the foot of the Rhætian Alps, traverses the valley of the Engadine, flows through Tyrol and Bavaria, and joins the Danube at Passau, after a course of about 300 miles.

Inn, a house where travellers are furnished, for the profit of the provider, with everything they have occasion for whilst on their journey. Inns may be set up without licence by any person, provided he refrains from selling excisable liquors, which of course require a licence. Public-houses, taverns, victualling-houses, and coffee-houses are all inns when the keepers of them make it their business to furnish travellers with food and lodging; otherwise they are not. From the Elizabethan period down to the eighteenth century the inns in Great Britain were the meeting-places of poets, writers, and wits. The most famous of such inns and taverns were: The Tabard, in Southwark, well known through Chaucer's *Canterbury Tales*; The Mermaid, in Bread Street, frequented by Shakespeare and Ben Jonson; The Devil Tavern, near Temple Bar; The Boar's Head, in East Cheap, connected with Sir John Falstaff and Mistress Quickly; The Mitre, in Fleet Street, frequented by Dr. Johnson; and many others.—BIBLIOGRAPHY: F. W. Hackwood, *Inns, Ales, and Drinking Customs of Old England*; H. P. Maskell and E. W. Gregory, *Old Country Inns of England.*

Innate Ideas, certain primary notions or impressions, supposed by some philosophers to be given to the mind of man when it first receives its being, and to be brought into the world with it. Descartes distinguished ideas into *innate*, *adventitious*, and *factitious*. An innate idea he described as not one that presents itself always to our thought, for there could be no such idea; but one that we have within ourselves the faculty of producing. He did not enumerate such ideas, however. What the followers of Descartes designate as *innate ideas*, those of Cousin term *universal*, *necessary*, and *absolute*. Kant advocated not innate but a priori conceptions.

Innerleithen, a village in Scotland, county of Peebles, 6 miles E.S.E. of Peebles, on the Leithen, and near the Tweed. It is the 'St. Ronan's Well' of Scott. Pop. 3855.

Innkeeper. An innkeeper is one who, for profit, keeps a house where travellers may obtain lodging and refreshment. He cannot legally refuse to receive any traveller who conducts himself properly, is free from infectious disease, and willing to pay a reasonable charge, and for whom there is accommodation. But he is not obliged to keep a traveller indefinitely, and if the character of traveller is lost by prolonged stay, such a guest may be ejected after reasonable notice.

An innkeeper is responsible at common law for loss of and injury to the property of a guest not caused by the guest himself or his servant or by inevitable accident. But by the Innkeepers Act, 1863, this liability is limited to £30, unless (1) the property is a horse or other animal, or the gear, or a carriage; (2) the loss or injury was caused by the fault of the innkeeper or his servant; and (3) the property was deposited with the innkeeper for safe custody.

The person of a guest cannot be detained for payment of the bill, but there is a lien over his property, and if he leaves without paying, the innkeeper may, after six weeks, advertize the property, in a London newspaper and one circulating locally, for sale by public auction, and after a further month proceed to sell and take payment of his bill and costs. See *Licence.*

Innocent, the name of thirteen Popes, of whom only the following need be particularly dealt with.—**Innocent I** succeeded Anastasius I as Bishop of Rome in A.D. 402. He supported St. Chrysostom, and renounced communion with the Eastern Churches on that account. In 409 he was sent to obtain terms of peace from Alaric, but without success. He died in 417, and is one of the most distinguished saints, his day being 28th July.—**Innocent II**, a Roman of noble birth, elected Pope in 1130 by a part of the cardinals, whilst the others elected Peter of Leon, who took the name of Anacletus. Innocent fled to France, where he was acknowledged by Louis VI and by Henry II of England; also by the Emperor Lothaire, who conducted him in 1133 to Rome, where Anacletus also maintained his claims as Pope. Innocent was obliged to retire, and though reinstated in 1137, Anacletus maintained himself until his death in 1138. Innocent in

1139 held the second Œcumenical Council in the Lateran, which condemned the opinions of Arnold of Brescia, and declared the decrees of Anacletus null. Innocent died in 1143.—**Innocent III**, Lothario, Count of Segni, born in 1161, was unanimously elected Pope at the age of thirty-seven. He displayed great energy, and much enhanced the Papal power. He excommunicated Philip Augustus, King of France, and laid his kingdom under an interdict in 1200 because Philip had repudiated his wife, and obliged the king to submit. He extorted a similar submission from John, King of England, who refused to confirm the election of Langton as Archbishop of Canterbury, by laying the kingdom under an interdict, and in 1212 formally deposing him. Almost all Christendom was now subject to the Pope, two Crusades were undertaken at his order, and his influence extended even to Constantinople. The cruel persecution of the Albigenses and the establishment in 1198 of the inquisitorial tribunals, from which the Inquisition itself originated, were noteworthy events of his pontificate. In 1215 he held a council by which transubstantiation and auricular confession were established as dogmas, and the Franciscan and Dominican orders were confirmed. Innocent died in 1216. He left various works on legal and theological subjects; and the *Stabat Mater*, *Veni Sancte Spiritus*, and other sacred hymns are said to have been written by him.—**Innocent XI**, Benedetto Odescalchi, born in 1611, served in his youth as a soldier, took orders at a later period, and rose through many important posts, until he was elected Pope in 1676, on the death of Clement X. He was eminent for probity and austerity. Though hostile to the Jesuits, whose opinions he attacked in the decree *Super quibusdam axiomatis moralibus*, yet he was obliged to condemn Molinus and the Quietists. Being involved in a dispute with Louis XIV, the authority of the Pope in France and elsewhere received a severe blow in the *IV Propositiones Cleri Gallicani* (Four Propositions of the Gallican Clergy, 1682). These disputes were highly favourable to the English Revolution, as they induced the Pope in 1689 to unite with the allies against James II, in order to lower the influence of Louis XIV. He died in 1689, and was succeeded by Alexander VIII.—BIBLIOGRAPHY: L. Pastor, *History of the Popes*; F. Gregorovius, *Rome in the Middle Ages.*

Innocents, Feast of Holy, variously styled Innocents' Day and Childermas, a festival observed in the Western Church (including the Anglican) on the 28th, and in the Eastern Church on the 29th Dec., in commemoration of the massacre of the children at Bethlehem by the order of Herod.

Innsbruck, a town of Austria, capital of the Tyrol, beautifully situated on the Inn, near the confluence of the Sill, surrounded by striking groups of lofty mountains. Among the chief buildings are the Hofkirche or Franciscan church, containing the splendid tomb of the Emperor Maximilian I and the tomb of Andreas Hofer; the church of St. James; the castle or palace; the Golden Roof, a sort of oriel window roofed with gilt copper, and projecting in front of a building originally a palace of Count Frederick of Tyrol; the town house; the Capuchin monastery; the university, founded in 1672; and the Ferdinand museum. Pop. (1920), 55,659.

Inns of Chancery, in London, nine institutions named Thavies Inn, New Inn, Symonds Inn, Clement's Inn, Clifford's Inn, Staple Inn, Lyon's Inn, Furnival's Inn, and Barnard's Inn, which formerly existed as preparatory colleges for law students.

Inns of Court, four very ancient societies in London exclusively invested with the right to call to the English Bar; also the buildings belonging to these societies, in which the members dine and barristers have chambers. The members belonging to these societies may be divided into benchers, inner barristers, utter barristers, and students. The benchers are the highest in rank, being usually King's Counsel; and it is they who have the right of granting or refusing a call to the Bar, or of disbarring persons unfit to practise. The four inns of court are the Inner Temple and Middle Temple (formerly the dwelling of the Knights Templars, and purchased by some professors of law more than five centuries ago); Lincoln's Inn and Gray's Inn. Each inn is self-governing, and all have equal privileges. In each inn building there is a hall, chapel, and library, besides sets of chambers occupied by barristers and solicitors. Previously to being called to the Bar it is necessary to be admitted a member of one of the inns of court and to go through a certain course of legal study and ' keeping terms '. Any person who has passed a public examination at any university in the British dominions may be at once admitted as a student to any of the inns. Every other person must pass an examination in the English and Latin languages and English history before a joint board appointed by the four inns. No solicitor, parliamentary agent, clerk to justice of the peace, or to any barrister, conveyancer, solicitor, &c., can be admitted as a student until such person ceases to act in any of these capacities and has taken his name off the roll of any court on which it may stand. The educational year is divided into four terms. Attendance is not compulsory on students either at lectures or private classes; nor is it essential to study the practice of law in the chambers of a barrister or pleader, though this is recommended. A term is kept by the student being present at six dinners during the term in the hall of the society to which he belongs, or three if he is a member of one of the British universities. Students are required to pass an examination in Jurisprudence, Roman Civil Law, Constitutional Law and Legal History, the Law of Real and Personal Property, Common Law, Equity, and Criminal Law, there being four examinations in each year. The Sex Disqualification (Removal) Act, 1919, legalized the admission of women.—BIBLIOGRAPHY: C. Headlam, *The Inns of Court*; T. Cunningham, *History and Antiquities of the Four Inns of Court and of the Nine Inns of Chancery*; W. J. Loftie, *The Inns of Court.*

Innuen′do (Lat. *innuere*, to hint), in actions of libel and slander, the defamatory meaning attributed by the plaintiff to the words of which he complains. They 'hint' at or imply something derogatory.

Inoculation, in medicine, the artificial setting up of a mild attack of a disease to render the individual insusceptible to natural infection. The principle was first widely applied in smallpox, being based on knowledge acquired by Lady Mary Montagu in Turkey. Here matter from a smallpox patient, when rubbed into a scratch on the skin, was shown to originate an illness much less severe than ordinary smallpox. Though equal immunity against the disease was thus secured, the method was superseded by Jennerian vaccination. Since the bacteriological epoch the principle has been widely taken advantage of. Pasteur used weakened cultures of anthrax to protect cattle against the disease, and his preventive treatment for hydrophobia in cases of persons bitten by mad dogs rests on a similar basis. Here the disease does not develop until about forty days after the bite, and Pasteur used this interval to accustom the body to meet the threatened attack by injecting small doses of a weakened virus obtained by drying the spinal cords of infected rabbits. Preventive inoculation against typhoid fever by the use of killed typhoid bacilli has markedly reduced the incidence of the disease in armies, and good results have been obtained by similar means in the pneumonia so prevalent in the South African mines. Even if disease is established, its course can be modified by inoculation. Thus, in a person suffering from boils, the injection of dead cultures of the causal bacterium prevents new boils forming. Such vaccines, as they are often called, have been used for the prevention of recurring colds, bronchitis, &c. A certain amount of success has also attended the treatment of local tuberculosis with extracts of the tubercle bacillus (tuberculins).

Inorganic Chemistry, name given to the study of the properties and constitution of elements and compounds other than those of carbon. It is not easy to draw a sharp line between inorganic and physical chemistry. Since the development of this more modern branch of the science many new theories have been introduced, and the structure of the more complex inorganic substances investigated. The idea of the atom as the smallest particle of elementary matter, although still a useful basis for the study of elementary chemistry, has to be abandoned, and it now appears that the atom of Dalton is an aggregation of particles or electrons, and not one single particle. Radio-chemistry has done much to advance research into the structure of the atom. Most of the views advanced on the structure of the atom are based on physical evidence, but some attempts have been made based on chemical considerations. For example, Lewis regards the atom of an element as built up of a central nucleus carrying a positive charge of electricity and surrounded by a shell of negative electrons. The nucleus is not affected by chemical reactions, and possesses an excess of positive charge equal to the number of the group to which the element belongs in the periodic table. The number of negative electrons in the shell may vary from 0 to 8. It is the shell which takes part in chemical change, and the number of electrons and the valence of the element are associated. The great variety of hypotheses dealing with the constitution of the atom has not established a definite valence hypothesis which will enable the chemist to present a more complete idea of the relationship between chemical constitution of a substance and its chemical and physical properties. Most of the valence theories formulated fit in well when dealing with simple chemical compounds, but when more complex compounds are studied, there are as many exceptions as there are substances obeying that particular theory; the subject of valence may therefore be regarded as in a transition stage. The development of organic chemical constitution based on the quadrivalence of carbon suggested that the constitution of other complex substances might be worked out in the same way, but so far this has not been realized.

A new view has to be taken of the chemical elements since the discovery of radium and the radio-elements. About 80 elements were known, each distinguished by definite chemical properties and a definite atomic weight, and no one element could be transformed into any other element. The study of the radio-elements revived the old idea of transmutation of elements, but in a new form. Among the radio-elements change is going on; thus radium loses α- and β-particles, and thus becomes transformed into other radio-elements. So although transmutation of metals as attempted by the alchemists is still unaccomplished, in certain series of elements transmutation does take place. (See *Radio-activity*.)

Each element has assigned to it a definite atomic weight, i.e. its relative weight compared with a standard. In 1910 attention was called to the fact that certain of the radio-elements were identical in chemical behaviour, and could only be distinguished by their radio-active constants, and when their atomic weights were determined these were found to be different. For example, ionium, radio-thorium, and thorium cannot be distinguished by chemical means, and yet their atomic weights are: ionium = 230, radio-thorium = 228, thorium = 232; thus showing that elements may have the same chemical properties and yet differ in atomic weight and radio-active constants. This led to the conclusion that chemical analysis may separate matter into types of matter and not into elements. These types, although chemically identical, may be found to be made up of more than one element when examined by other methods. Soddy gives the name *isotopes* (q.v.) to these apparently identical elements. Owing to research in this direction, the atomic weight of lead derived from various sources has been determined, and is found to vary by several units. Ordinary lead may be regarded, therefore, as possibly a mixture of two or more isotopes. The view has been suggested that wherever the atomic weight of an element is not a whole number, it may represent the mean atomic weight of a mixture of chemically similar elements.

The so-called 'rare earths' take an important part in modern inorganic chemistry. These were only known at first in minute quantities, but in recent years have been proved to be widely distributed, and can be obtained in sufficient quantity to render them of practical importance; the name 'rare earths' can hardly be applied to these now. The rare earths are made up of a series of basic oxides divided into three groups; the cerium group, the terbium group, and the ytterbium group all show a close resemblance. The place of these elements in the periodic classification is a much disputed point, and has not as yet been satisfactorily settled. In 1884 Welsbach took out a patent which was the forerunner of the incandescent-mantle industry. That date marks the beginning of the practical importance of the rare earths. At that time the deposits of these 'earths' known were very limited, but soon afterwards large deposits of monazite sand were discovered in Brazil and Carolina, and, later, thorianite in Ceylon. These discoveries made it possible to obtain the earths cheaply. Cerium and thorium salts are the earths used for the industry, and their use depends on the fact that the oxides become incandescent when heated. In the separation of these substances much material has been rendered available for examination of the other associated earths, so that through the development of the industry the by-products have been most valuable in the investigation of the elements of the rare-earth series.

The heats of formation and the heats of decomposition of compounds, the law of mass action, the laws governing liquefaction of gases, &c., all play a part in modern chemistry, and many elements and compounds have been produced, or their method of production improved, owing to the study of these laws.

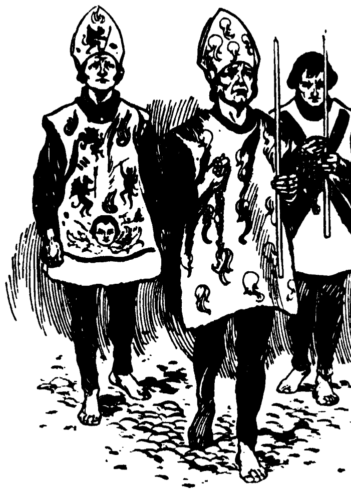
The use of finely divided metals in chemical reaction has been extended since the researches of Sabatier and Senderens, and various fats and oils are now 'hardened' and rendered useful by hydrogenation in presence of finely divided metallic nickel. Platinum in the form of platinum black is used as a catalyst in numerous industries, for example, the formation of nitric acid from ammonia and air. The finely divided metals are said to act as catalysts. Other reactions are known where the catalyst need not be a metal; thus ammonia may be synthesized from hydrogen and nitrogen in presence of metallic osmium, but the limited supply of this material and its cost prevent its use on a large scale. Ferric oxide is now used as catalyst, and under certain conditions causes the union of nitrogen and hydrogen to form ammonia. An interesting process for the preparation of metals depends on the great affinity which aluminium has for oxygen. If aluminium powder be heated with oxide of nickel, the aluminium is transfused into aluminium oxide and metallic nickel is produced, and so much heat is given out during the process that the metal is fused. Chromium and other refractory metals may be produced in this way. Use has been made of this process, known as the 'Thermit' process, both for the preparation of metals and in welding metals.

Inosite, or **Inositol**, $C_6H_6(OH)_6$, a naturally occurring substance having the same molecular composition as the carbohydrates and often classed with them. It is found in the lungs, kidneys, &c., more abundantly in certain plants, such as unripe French beans, peas, and asparagus.

Inowrazlaw (ē-nov-ràts′làv), or **Jung-Breslau** (Ger. *Hohensalza*), a town of Poland, formerly in the Prussian province of Posen, with beds of rock-salt, saline springs, and various industrial works. Pop. 26,000.

Inquisition, in the Roman Catholic Church, a court or tribunal established for the examination and punishment of heretics. The institution was founded in the twelfth century by Father Dominic, who was charged by Pope

Innocent III with orders to incite Catholic princes and people to extirpate heretics. Pope Gregory IX in 1233 completed the design of his predecessors, and the Inquisition was successively introduced into several parts of Italy, and, with certain limitations, into some provinces of France. It never managed to establish itself in England at all. The tribunals of faith were admitted into Spain in the middle of the thirteenth century; but a firm opposition was made to them, particularly in Castile and Leon, and the bishops there maintained their exclusive jurisdiction in spiritual matters. A change, however, afterwards took place; and while in other countries of Europe the Inquisition could never obtain a firm footing—in some falling entirely into disuse, as in France—in Spain it became firmly established towards the end of the fifteenth century, under Ferdinand and Isabella, who used it as a weapon to break the strength of the nobles, and to render the royal authority absolute. In 1477, when several turbulent nobles had been reduced in the southern part of Spain, Queen Isabella went with the Cardinal Pedro Gonzalez de Mendoza to Seville, where this prelate, as Archbishop of Seville, made the first attempt to introduce the Inquisition, especially with regard to citizens of Jewish origin. After this the design was disclosed of extending it over the whole country. In the Assembly of the States held at Toledo, 1480, the erection of the new tribunal was urged by the cardinal, and after some opposition established under the name of the General or Supreme Inquisition. The new court was opened in Seville in 1481. Torquemada, prior of the Dominican convent at Segovia, and father-confessor to the Cardinal Mendoza, had already been appointed by Ferdinand and Isabella the first Grand Inquisitor in 1478. The Dominican monastery at Seville soon became insufficient to contain the numerous prisoners, and more than 2000 persons are said to have been burned alive in the first year or two. The Pope, however, opposed the establishment of the Spanish Inquisition as the conversion of an ecclesiastical into a secular tribunal, and repeatedly summoned the Inquisitor-General to Rome. Torquemada, instead of obeying, sent a friend to defend his cause, and in 1483 Sixtus IV was obliged to yield and acknowledge Torquemada as Inquisitor-General of Castile and Leon, and a later Bull subjected Aragon, Valencia, and Sicily to the Inquisitor-General of Castile. The introduction of the new tribunal was attended with risings and opposition in many places, as at Saragossa, but the people were obliged to yield in the contest. The tribunal was wholly dependent on the Spanish sovereigns, and became a powerful instrument for establishing the arbitrary power of the king on the ruins of the national freedom; for putting down the clergy, who had previously acknowledged only the jurisdiction of the Roman see; and for oppressing the nobles, and taking away the privileges of the estates. The property of those who were condemned fell to the king; and, although it had been granted to the Inquisition, it was still at his disposal. Ferdinand and Isabella, indeed, devoted a part of this property to founding convents and hospitals; but the Church, notwithstanding, lost many possessions by means of the Inquisition. It is computed that there were in Spain above 20,000 officers of the Inquisition, called *familiars*, who served as spies and informers. These posts were sought even by persons of rank, on account of the great privileges connected with them. The supreme tribunal, under the Inquisitor-General, sat at Madrid. He was assisted by a council of six or seven, and there were various officials belonging to the court, the one specially appointed to carry on prosecutions being called the fiscal. As soon as an accuser appeared, and the fiscal had called upon the court to exercise their authority, an order was issued to seize the accused. If he did not appear at the third summons, he was excommunicated. From the moment that the prisoner was in the power of the court he was cut off from the world. The advocate who was appointed to defend him could not speak to him except in the presence of the inquisitors. The accused was not confronted with the accuser nor the witnesses before the court, neither were they made known to him; and he was often subjected to the torture to extort a confession, or to explain circumstances which had not been fully explained by the witnesses. Imprisonment, often for life, scourging, and the loss of property were the punishments to which the penitent was subjected. Wearing the *san-benito*, or vest of penitence—a sort of coarse yellow tunic, with a cross on the breast and back, and painted over with devils—was a common method of punishment, the penitent having to wear it for a fixed period. When sentence of death was pronounced against the accused, the *auto da fé*, or ceremony of burning the heretic in public, was ordered. This usually took place on Sunday, between Trinity Sunday and Advent. As ' the Church never pollutes herself with blood ', a servant of the Inquisition, at the close of the procession and ecclesiastical ceremonial preceding the execution of the sentence, gave each of those who had been sentenced a blow with the hand, to signify that the Inquisition had no longer any power over them, and that the victims were abandoned (*relaxados*) to the secular arm. A civil officer, ' who was affectionately charged to treat them kindly and mercifully ', now received the condemned, bound them with chains, and led them to the place of execution. They were then asked in what faith they would die. Those who answered the Catholic were first strangled; the rest were burned alive. Even in more modern times the original organization of the Inquisition was but little changed, but the *auto da fé* was seldom witnessed during the eighteenth century. The powers of the Inquisition afterwards became more limited, however, by various restrictions, and at last, under Joseph Bonaparte, it was abolished altogether in 1808. It was re-established in 1814 by Ferdinand VII, but on the adoption of the constitution of the Cortes in 1820 it was again abolished. It was, however, partially restored in 1825, and finally abolished only in 1834. According to the estimate of its historian, Llorente, the number of victims of the Spanish Inquisition from 1481 to 1808 amounted to 341,021. Of these nearly 32,000 were burned.



Various Styles of San-benito

The Inquisition, abolished for Italy by Napoleon in 1808, restored in Rome by Pius VII in 1814, existed, nominally at least, as one of the 'congregations' until 1870. The censorship of the press was under it.—Bibliography: J. A. Llorente, *History of the Inquisition in Spain*; L. Pastor, *History of the Popes*; H. C. Lea, *History of the Inquisition of the Middle Ages* (3 vols.); *History of the Inquisition in Spain*; S. Reinach, *Cultes, Mythes et Religions*.

Insanity is due to the disordered functions of the mind. Contrary to the dogma of psychological medicine that is the fashion at the present time, such disorders are not in every case, or in the majority of cases, the result of any physical changes in the brain, but are psychical in origin. By this is meant that some worry or anxiety or some disturbing personal experience of one kind or another has so influenced the feelings and behaviour of an individual that he reacts in an unusual manner to emotional problems which every human being has to solve. The exciting cause of the disturbance and the emotional storm that results from it may be thwarted ambition, business worries, family anxieties, the disaccord between individual sexual desires and social convention, or any of the thousand and one conflicts that develop between the instinctive impulses and the complex conditions and the innumerable restraints of modern civilized life. It is only within recent years that certain physicians have come to realize that in the majority of cases of mental alienation the explanation is to be sought not in the physical damage to the brain nor in the less tangible effects of heredity so much as in the individual experiences of each patient. At the same time, and as an integral part of the scheme of interpretation, psychologists have begun to pay attention to the vast importance of the instinctive and emotional aspects of mental life, both under normal and abnormal conditions, and to realize how profoundly the thoughts and actions of every individual are affected by unconscious effects of experience and of instinctive impulses.

There are many kinds of mental disorder which are directly due to physical damage to the brain. Anything that destroys certain parts of the cerebral cortex, whether mechanical injury, the growth of a tumour, the prolonged action of a poison, or the effects of certain organisms, such as that of syphilis, may affect the intelligence and produce different phases of insanity, culminating in that complete loss of control which is called *dementia*. Of such forms of mental alienation due to a physical cause perhaps the most important is *general paralysis of the insane*. This progressive form of mental degeneration, which leads sooner or later to complete dementia, is due to the action of the spirochæte of syphilis, and as a rule does not reveal itself until many years after the primary stage of the venereal disease to which the diseased condition is due. In the earlier stages of general paralysis the patient often is subject to grandiose delusions and the reckless spending of money on useless objects.

Another common cause of insanity is the habitual ingestion of poisons, such as alcohol and various drugs that may affect the structure of the cerebral cortex. But it must not be forgotten that the resort to alcohol, opium, hashish, cocaine, &c., is often prompted by the desire to get some relief, however temporary, from worry and anxiety, which in the end may be the real exciting cause of an insanity that may be wrongly attributed to the drugs and the physical changes in the brain following their use.

Severe epilepsy may in course of time be followed by degenerative changes in the brain and a progressive impairment of intelligence, passing into dementia or conditions of paralysis. But it must be remembered that in the majority of cases of epilepsy no physical affection of the brain can be detected; in fact the view is now emerging that many, if not all, cases of true epilepsy are functional disorders due to some emotional disturbance in early childhood. In old age the cerebral cortex is liable to a wasting that may manifest itself in senile dementia. Only a relatively small proportion of mentally-deranged patients (perhaps about 6 per cent) suffer from the so-called maniac-depressive form of insanity which the general public are apt to associate with the idea of lunacy. Mania and melancholia are not diseases, but merely symptoms or different phases in the manifestations of certain mental disorders. Melancholia is a condition of abnormal sadness which may be present without any defect of memory or even of intelligence. Mania is an abnormally excited state with great restlessness. In these affections no recognizable changes in the brain can be detected, but they are often associated with some emotional cause such as thwarted ambition.

According to Jung nearly half of the asylum patients "suffer from the real and common mental disease called *dementia præcox*. The name is a very unhappy one, for the dementia is not always precocious, nor in all cases is there dementia. Unfortunately the disease is too often incurable; even in the best cases, in those that recover, where the outside public would not observe any abnormality, there is always really present some defect in the emotional life. The picture presented by the disease is extraordinarily diverse; generally there is some disorder of feeling, frequently delusions and hallucinations."

Within recent years far too much significanee has been attached to the influence of heredity as a cause of mental alienation. Too little attention has been given to the part played by social worries and anxieties and the general domestic upheaval in a home where an insane parent is living. The children in such an environment will be subjected to a variety of emotional disturbances and social shocks, and to all the conditions that are apt to excite mental conflict. In such circumstances one can explain the genesis of many cases of mental disorder without resorting to the factor of heredity. The exaggerated importance attached to heredity in deciding whether or not an individual is insane—and this applies with special significance to the procedure in courts of law—is a dangerous phase of opinion which it is to be hoped is only transitory.

The new outlook on the problems of mental disorder which the fuller understanding of its psychical origin has afforded is a much more hopeful prospect than the old attitude of despair, which in practice meant leaving the patient until his ailment became fully developed, and in many cases beyond hope of cure, and then incarcerating him or her in an asylum. If the nature of the most common forms of mental disorder is recognized at an early stage, its true cause determined, and appropriate treatment given by a wise and understanding physician, there is now a reasonable hope of curing the trouble. The old attitude of persuading people with real anxieties and mental conflicts to 'forget their worries' is the root of the failure in the past. The only satisfactory method of dealing with such troubles is for the patient to unburden them to a wise and sympathetic adviser, and by discussion to look at his difficulties calmly and rationally, stripped of all the emotional colouring that makes such conflicts so destructive to his peace of mind, i.e. his mental health. As Siegfried Sassoon has expressed it with all the true poet's insight and power of emphasizing essentials:

> And it 's been proved that soldiers don't go mad
> Unless they lose control of ugly thoughts
> That drive them out to jabber among the trees.

—BIBLIOGRAPHY: F. Peterson, *Mental Diseases*; Maudsley, *The Pathology of Mind*; Sir J. B. Tuke, *Dictionary of Psychological Medicine*; B. Hart, *Psychology of Insanity*; B. Hollander, *First Signs of Insanity*; W. H. Stoddart, *Mind and its Disorders*.

Inscriptions. See *Cuneiform Writing*; *Hieroglyphics*.

Insectiv'ora, an order of mammals living to a great extent on insects. They are plantigrade, and have a well-developed clavicle, a discoidal placenta, incisor teeth larger than the canine, and molar teeth set with sharp conical cusps. They are usually of small size, and many of them live underground, hibernating for some months. They are found throughout the world with the exception of Australia and South America. The chief insectivorous families are the Talpidæ or moles, the Soricidæ or shrew-mice, and the Erinaceidæ or hedgehogs.

Insectivorous Plants. See *Carnivorous Plants*.

Insom'nia, or Sleeplessness, varies from absolute wakefulness to a dull stupor or fitful slumber disturbed by unpleasant dreams. The most common cause is anxiety and worry; insomnia from this cause may often be remedied by frankly discussing the causes of the worry with some wise counsellor, and by learning to take a rational view of the matter, getting rid of the anxiety. Other causes are bad ventilation and indigestion. Brisk evening exercise in the open air, cold baths, or mustard foot-baths are recommended, and drugs have sometimes to be resorted to in continued insomnia, but the use of opium and chloral hydrate is to be discouraged, the safest drug being bromide of potassium. Insomnia as the result of indigestion, constipation, &c., is to be treated by the removal of the cause. See *Sleep*.

Inspira'tion, in theology, is the infusion of ideas into the human mind by the Holy Spirit. By the *inspiration of the Scriptures* is meant the influence of the Holy Spirit exercised on the understandings, imaginations, memories, and other mental faculties of the writers, by means of which they were qualified for communicating to the world divine revelation, or the knowledge of the will of God. Theological writers have enumerated several kinds or degrees of inspiration, which are founded upon the supposition that God gave to the authors of the Bible that measure and degree of assistance which was just suited to the nature of the subjects which they committed to writing, and did not supersede the use of their natural powers and faculties, and of their acquired knowledge, where these were sufficient. Thus distinctions have been drawn between inspiration of direction, inspiration of superintendency, inspiration of elevation, and inspiration of suggestion. All orthodox theologians agree in ascribing divine assistance to the scriptural writers, but differ widely as to the degree, extent, and mode of inspiration. The advocates of *plenary* inspiration assert that every verse of the Bible, every word of it, every syllable, every letter is the direct utterance of the Most High. In opposition to this theory some writers confine inspiration to all that is directly religious in the Bible, to all that is matter of direct revelation, leaving out of the question all that can be known by ordinary intellectual application. Other authorities attribute inspiration only to the spirit, ideas, or doctrines of the Scriptures, exempting the strict form or letter. Some go yet further, and include in the fallible sections the mode of argument and expository details. Opponents of the idea of inspiration and revelation maintain that real divine revelation lies in human progress. They base their theory upon the facts of evolution as seen in history, and compare the causes operating in religion to the causes which are responsible for civilization in general. The Bible, therefore, is only a human book, but the greatest of all human books. —BIBLIOGRAPHY: J. Orr, *Revelation and Inspiration*; W. Sanday, *Inspiration*; R. F. Horton, *Inspiration and the Bible*; G. L. Raymond, *Psychology of Inspiration*.

Insterburg, a town of Prussia, province of East Prussia, 16 miles west of Gumbinnen, at the confluence of the Angerap and Inster, which here form the Pregel. It has iron-foundries, distilling, brewing, manufactures of linen, leather, and earthenware. The town was occupied by the Russians during the European War (Aug., 1914). Pop. 31,600.

Instinct, the power by which, independently of all instruction or experience, and without deliberation, animals are directed to do spontaneously whatever is necessary for the preservation of the individual, or the continuation of the kind. Three main theories have been held with regard to instinctive actions: (1) That these various impulses and faculties were bestowed by nature upon each species. (2) That instinct is the accumulated results of individual experience, fixed by repetition, and transmitted as an inheritance to succeeding races. In this view instinct is intelligent in its origin, an organized experience, a 'lapsed intelligence'. (3) That the greater number of complex instincts arise through the natural selection of variations of simpler instinctive actions—variations arising from unknown causes. The last theory is that of Darwin. See *Natural Selection*; *Psychology*.

Institute of France, the principal philosophical and literary society of France, organized after the first storm of the French Revolution in 1795 to replace the Académie Française, the Académie des Sciences, and the Académie des Belles-Lettres et Inscriptions, its object being the advancement of the arts and sciences. The Institute now embraces five distinct divisions or *académies*, each having a separate field of knowledge or thought. (1) The *Académie Française*, originally established early in the seventeenth century. Its department is the French language and literature, and its membership is limited to 40. (2) The *Académie des Inscriptions et Belles-Lettres*; ordinary members, 40. (3) The *Académie des Sciences*; ordinary members, 65. (4) The *Académie des Beaux-Arts*; ordinary members, 40. (5) The *Académie des Sciences Morales et Politiques*; ordinary members, 40. Each academy has an independent organization and a free disposition of the funds committed to it. Members are elected for life by ballot, and have an annual allowance of 1500 francs. To each academy, except the Académie Française, are attached some honorary members. Admission into the Académie Française is a great object of ambition with most French literary men. The name of this distinguished body was changed in 1848 to *Institut National de France*, having previously been called *National*, *Imperial*, and *Royal* at different times. The Institute of France receives an annual grant from the Government, and has also received, as a donation from the Duc d'Aumale, the domain of Chantilly. It distributes annually in literary and scientific prizes about

680,000 francs. Among these prizes the Prix Osiris, 100,000 francs, is the most noteworthy.

Institut Français, a French educational institution in London, founded in 1910 under the name of Université des Lettres Françaises. It organizes French lectures and classes, and generally fosters an understanding between Great Britain and France.

Insulating Materials are used in the construction of electrical plant, apparatus, and machinery. A good insulating material must have high dielectric strength (measured in kilovolts per centimetre) and high electrical resistance (measured in megohms, each of which is one million ohms). For most purposes it must be tough, flexible, and non-hygroscopic, and must be able to withstand continuously a fairly high temperature. The material is generally used in sheets or tapes, and its dielectric strength is found by placing a known thickness (usually 0·01 inch) between two flat circular electrodes, and increasing the pressure between them until the material breaks down electrically (i.e. is unable to withstand electrical pressure). This 'break-down voltage' is divided by the thickness of the layer and the kilo-volt per centimetre (or per inch) deduced. The dielectric strength can be raised a great deal by prolonged baking, but this process often injures the material, and it is therefore not wise to use higher dielectric strengths than are really necessary. The materials in general use are as follows:

Dry Air.—This is a good insulator, but its field of application is limited.

Paper.—This material is used in high-pressure electric cables. A tough paper is wound on to the copper conductor by a winding-machine. The coil of cable is then baked in a vacuum oven to expel all moisture, and, when sufficiently baked, impregnating material is run into the oven from the bottom until it covers the coil. Atmospheric pressure is then slowly restored, and the impregnating material is pushed home into the paper. The impregnating material is usually a paraffin or bitumen base, dissolved in a thin oil. The exact composition is a piece of the manufacturer's stock-in-trade. Various varieties of paper are used in the insulation of machinery, and these go under their trade names, such as fuller board, leatheroid, &c.

Cloth.—Cloth which has been suitably treated is sold under various names. 'Empire cloth', for instance, is a cambric cloth which has been treated with linseed oil.

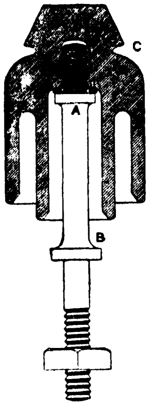
Micanite.—This material is a very good slot and commutator insulation. It is made of thin flakes of mica, which are stuck together with a flexible varnish. It is also made in tubes, which can be sawn and worked very much like wood. It can be readily moulded to suit various slot shapes. Micarta is a variety of this material.

Glass.—Glass, varnished with shellac, is used in certain kinds of electrical apparatus.

Porcelain.—Porcelain insulators are used for insulating the wires from the poles in telegraph and overhead power lines.

Dielectric Strengths.—Average figures are: air, 80; paper, 250; cloth, 750; micanite, 800; glass, 300; porcelain, 300. The figures are in kilovolts (maximum) per inch.—Bibliography: F. W. Peek, *Dielectric Phenomena*; A. Gray, *Electrical Machine Design.*

Insulator. A body which offers very great resistance to the flow of electricity through it or over its surface. There is no perfect insulator of electricity, just as there is no perfect conductor. An electric charge may be retained on a body by suspending the body by a silk thread, or by supporting it on a stem made of ebonite, glass, porcelain, or sulphur. In telegraphic systems, the overhead wires are insulated by being attached to masses of glazed porcelain of the shape shown in the figure. Certain oils have good insulating properties. One of the best insulators is dry air; its excellent insulation may, however, be destroyed by the presence of radium, or by the action of X-rays or other ionizing agent. The essential requirement in an insulator is that it should not puncture or break down under the action of the maximum voltage to which it is subjected. To carry low-tension currents, wires can be employed which are covered with cotton; better insulation is afforded by a covering of silk or enamel; whilst india-rubber forms the basis of the insulating cover for cables which carry high-tension currents. In general, a rise of temperature reduces the insulating property of a material, and the presence of moisture has a similar effect.



Cordeaux Screw Insulator

B, Bolt provided with shoulder A, upon which an elastic ring is placed. The porcelain cup C is screwed down upon this ring.

Insurance as a business comprehends most varied contracts by which, in general principle, one party agrees, for a consideration, to pay to another party a sum of money, or make good the loss, upon the occurrence of a stipulated contingency classified under the headings 'fire', 'life', 'marine', 'accident', and 'general'. Indemnification is the common basis of contract. It is practised by mutual or proprietary companies which are associated or non-associated (i.e. acting either upon conventional or independent experience) and by Government in many forms. The large joint-stock companies, owing to their underwriting all classes of insurances, are known as the 'composite' offices. Without the protection of insurance, great undertakings would not be attempted, nor could they be carried on. Banking must have that collateral security whether it be in connection with buildings or goods upon which loans are granted. The thrifty must have provision for their small savings against the contingencies of sickness, accident, and death.

The most common terms used in the practice of insurance are as follows: *insurance* and *assurance* are used synonymously, but in life offices the word 'assurance' is most consistently used. The *insurer* or *underwriter* is the party to the contract who undertakes to insure or assure. The insured or assured is the party to whom the insurance is granted. The *rate* is the charge per cent or per mille on the amount insured. The *premium* is the amount of consideration given by the insured to the insurer. The *risk* or *peril* refers to (1) the liability undertaken by the insurer, (2) the subject insured, or (3) the liability of the insured. The *policy* is the document containing the definition of the contract or the instrument of agreement. The *cover note* is the acknowledgment of temporary protection pending decision on the *proposal*, which is the overture. The cover note is also termed *interim protection note* and *deposit receipt*.

The term 'underwriter' was at one time confined to marine insurance, and referred to the individual who subscribed his name to the 'underwriting' sheet or policy for a fractional part of the entire sum to be covered, but it is now applied generally.

History.—Insurance in one form or another existed in the remote ages, and was effected by voluntary or compulsory contribution. The oldest form of insurance as practised at present is *marine insurance*. The commerce that grew up between Italian and other ports of the Mediterranean was so important that provisions of the character must have been in vogue. Marine laws observed in the Levant became known as the Rhodian Laws, which would indicate the periods (900 and 700 B.C.) of Rhodian prosperity. There is, however, no evidence that marine insurance existed commercially before A.D. 1000. It is recorded by Villani—the Florentine historian (who died in 1348 at an advanced age)—that when the Jews were expelled from France in 1182 by Philip Augustus, they adopted a system of insurance of their property. At the close of the twelfth or beginning of the thirteenth century it was practised by Lombard merchants, and it was not until the early part of the sixteenth century that they (the Lombards) brought the system from Italy to London, although in 1601 the Government of Elizabeth (43 *Eliz.*, cap. xii) declared that marine insurance had existed from time immemorial, and described it as a means "whereby it cometh to pass that upon the loss or perishing of any ship there followeth not the undoing of any man, but the loss lighteth rather easily upon many than heavy upon few, and rather upon them that adventure not than upon those who do adventure, whereby all merchants, especially those of the younger sort, are allured to venture more willingly and more freely".

In 1688, at a coffee-house kept by Edward Lloyd in Tower Street, London, the institution known as 'Lloyds' was originated. Four years afterwards it was moved to Lombard Street, and again in 1774 the business was removed to the Royal Exchange, where it is still conducted, although the building has been twice burned down. A good number of insurance companies also carry on business in the same building. The coffee-house was a meeting-place for merchants and seamen, and in those far-off days the policies were there arranged and subscribed by regular attenders. Edward Lloyd died in 1712, but his name survived and was associated with a monopoly in marine insurance until 1720, when insurance companies were first established by royal favour to issue marine policies. In 1871 Lloyds became an incorporated body for the purpose of conducting marine insurance business, and it was not until the year 1908 that a majority of its members brought about a change with a view to maintaining and enhancing its credit without interfering with the individual liberty of members who now subscribe to all forms of insurance contracts, each upon his own behalf. *Lloyds Register of Shipping*, founded in 1760 and reconstituted in 1834, is a separate body, and issues an underwriter's hand-book and classification of seagoing vessels from which the familiar phrase of "A1 at Lloyds" is extracted.

To the Great Fire of London in 1666 is attributed the development and rapid progress of systematized insurance against perils of all kinds. Modern *fire insurance* is thus recognized as essentially British. It had its genesis and early practice in London, and seems to have followed in the track of British shipping throughout the world.

Some Historic Fires.—The following are the most notable: London, 1666, £10,000,000; Chicago, 1871, £33,000,000; Boston, U.S.A., 1872, £14,000,000; Baltimore, 1904, £10,000,000; and San Francisco, 1906, £50,000,000. The last mentioned cost the British companies no less than £30,000,000. This calamity, which ranks as the worst ever experienced, had its origin in an earthquake. The area of the fire was 7 sq. miles, and the total loss of life was about 1000.

The seventeenth-century fire insurance offices deemed it necessary that no building should be considered insured by them until the 'mark' of the insuring office had been actually affixed thereon. This was apparently to prevent fraud by reason of a person obtaining a policy indirectly after the fire had happened. These 'trade marks' were designed in lead or copper plates or shields about twelve inches in diameter, and some may yet be seen attached to old buildings, for the practice was continued past the middle of last century. As the insurance companies increased in numbers, so did their private fire and salvage corps multiply, until in 1808 55 engines were kept in London alone. It is recorded that it was no uncommon incident that a brigade on arrival would withdraw immediately upon noticing the 'fire mark' of another office, leaving the extinguishment to the brigade belonging to the insuring office. In 1825 a number of these companies consolidated their fire brigades, and in 1833 all were united, but not until 1866 were they turned over to the city, and in accordance with the Metropolitan Fire Brigade Act, 1865, the companies contribute towards the expense of maintaining the fire brigade on the basis of the amount insured. Tabulated returns for 1921 show that the gross sums insured against fire during the previous year in respect of property in the administrative County of London amounted to £1,582,537,305. In 1869 a tax payable by the insured, based on the amount covered by his policy, was abolished, being looked upon as a tax upon prudence.

The oldest existing insurance office in the world was founded in 1710, and it was the first to transact the insurance of personal property—previously only buildings were covered—and it was found necessary to provide a body of men to remove insured goods from burning buildings, and to protect them later from thieves and pilferers. It may be assumed that that office was the originator of the modern salvage corps, now established by the fire offices in London, Liverpool, and Glasgow.

In the early days of insurance of all kinds it was found necessary for offices or underwriters to meet occasionally for consultation, for protective measures, mutual advantage, and benefit, and in 1791 the first combination of London fire offices was established. In 1858 the association known as the Fire Offices Committee was instituted, with control of its branch establishments through the kingdom, for rating or salvage operations, superseding the old 'Scotch Fire Offices' of Edinburgh, established in 1829.

Average.—Any reference to insurance would be incomplete without some even brief description of 'average', for the governing principle in carrying on the business in all its ramifications is the application of the law of average. In fire insurance, however, we have the phrase 'subject to average' very often as a condition of the policy. In this case, to obtain full recovery of any partial loss, the total amount of insurance must represent the total value of the property, and if through failure or otherwise any underwriter or co-insurer becomes a defaulter, then the insured is deemed to be so much underinsured, and must bear a proportion of the loss accordingly. The clause has its variations, but all bear upon the fact that the insured is free to carry as much or as little insurance as he deems needful, but fixes the proportion of the loss payable to such as the insured has chosen to pay for. If he insures for only one-half, then he can only recover one-half of the loss. If he insure the whole of the value, the whole of the loss is recoverable. Some of the forms of average only operate, however, after a certain percentage in favour of the insured has been allowed, and instead of being required to cover to the full value of the property to obtain indemnity for any loss he may sustain, he may safely insure for 50, 75, or 90 per cent, as the case may be, of the total value at risk, and recover full partial loss. With regard to marine insurance the term 'average' has a different purpose, and the origin of its present-day meaning is not traceable. Here are some of its forms: *particular average* is the damage to, or partial loss of, particular goods insured, for which a contribution may be due from the underwriter. E.g. 'A' insured ten cases of grocery goods. On arrival at destination one or all were found to be damaged by perils of the sea; that would be 'particular average'. *General average* is a contribution due from all interests, and, if insured, recoverable from the insurer. It occurs if during the voyage sacrifices be made of any part of the ship or cargo, or any extraordinary expense incurred to prevent loss of the whole or to rescue the whole from unusual peril; or if the ship be on fire, the cargo damaged by the water would be 'general average', but the cargo damaged by fire only would be 'particular average', because the damage from that cause would be accidental. 'General average' is a part of maritime law, and its underlying principle in practice is equity.

A summary of insurances that may be effected under the various headings follows:

Fire Insurance indemnifies against loss occasioned by a single occurrence. Rates vary according to the hazard of risk and are fixed on a minimum basis, generally the result of wide and mature experience of the combined action of the offices. Lightning losses are paid for whether fire ensues or not. Losses by explosion of domestic boilers or of illuminating gas (except on premises where gas is manufactured) are covered as fire damage. Damage caused by water in extinguishing a fire is regarded as fire damage.

Householders ‘ comprehensive ’ policies are now issued by which buildings are covered against fire, explosion, lightning, thunderbolt, and damage by burglars, and household effects are covered against loss or damage by fire, explosion, storm, tempest, flood, bursting of water-pipes, earthquake, lightning, thunderbolt, burglary, housebreaking, larceny, theft, aircraft, also loss of rent, breakage of mirrors, damage to servants' goods, compensation for death by fire or burglary, riot and civil commotion, strike and labour disturbances in Great Britain, accidents to servants, and public liability.

Loss of Profits through Fire.—The interruption in trading may be separately insured against, covering the reduction in net profits, standing charges that require to be paid such as interest, on debentures, borrowed capital, salaries, rents, rates, and taxes, and the increased cost of continuing a business in such circumstances.

Life Assurance insures against an event the occurrence of which is inevitable, and is effected with or without ‘ profits ’, i.e. participation or non-participation in the profits earned, for which purposes a valuation is made quinquennially, as required by the Assurance Companies Act, 1909, and a reversionary bonus declared according to the ascertained result. The most popular systems of life assurance are: whole life assurance; endowment assurance, by which the sum assured is payable at death or maturity of the policy at a certain age; joint lives or partnership assurances, payable at first death.

Marine Insurance undertakes to indemnify a person against the loss of ship, goods, freight, anticipated profits, or any other insurable interest through any of the perils and adventures connected with navigation.

Accident or Casualty Insurance may be said in some measure to owe its origin to the development of railway travelling, for in 1845 the record begins with a list of insurance projects to insure against accidental death and injury, and on 3rd June, 1850, by adoption of a suggestion to insure “ compensation for bodily injury occurring to any person or persons from any accidental or violent cause not occasioning death ”, the Accidental Death Insurance Company instituted the modern system of accident insurance. In the sea laws of Wisby under date 1541, mention is made of the practice of insuring the lives of masters, and many forms of accident insurance were in vogue making provision against personal accidents in ancient times for perils at sea, and in compensation for personal injury in wartime. In its present-day form it represents one of the most popular adaptations of the principles of insurance to the requirements of everyday life and legal obligations of the public. Workmen's compensation, employers' liability, personal accident and illness, third party or liability to the public for personal injuries and damage to property, driving accidents, property owners' liability, burglary, plate glass, fidelity guarantee (court, Government, and commercial bonds), securities in transit, druggists' liability, life insurances, and forged transfers are all specifically insured in this department.

The following may be included under the term ‘ General Insurance ’:

Motor Insurances include claims by the public, loss or damage to the cars, accidents to the insured, medical and surgical expenses, expenses incurred in defence of police court proceedings instituted against the insured owners of motorcycles, commercial motor vehicles, private motorcars, and cars of a private type used for business.

Engineering Insurance.—Sir William Fairbairn founded at Manchester the first association for the systematic inspection and general supervision of steam-boilers in 1854. Boilers and other steam vessels are insured against damage caused by explosion or collapse, and steam-, gas-, oil-engines, and electrical machinery against breakdown. Gas-making plants are insured against all damage by explosion, lifts, hoists, and cranes against breakdown, and liability in respect of personal injury.

Live-stock Insurance.—Insurances are effected on horses, bulls, and blood-stock against loss which may be sustained by death from accident or disease.

Claims.—When a claim arises it is necessary that brief particulars should be at once intimated, quoting the policy number, and the necessary form will then be sent to be filled up. See also *National Health Insurance.*

Intellect (Lat. *intellectus*, understanding, from *intelligere*, to perceive), a philosophical term denoting the capacity of knowing, the thinking part of the mental constitution, or the mental process concerned in the function of cognition. More widely it is applied to the whole rational nature of man. Mind is made up of three elementary constitutents—emotion, volition, and intelligence. When we experience pleasure or pain, we are said to feel, a condition which is referred to the emotions; when we act to obtain the one or escape the other, we exert our will; when we remember, compare, or reason, intelligence is brought into play. The powers of the intellect have been variously classified. Aristotle distinguished between *intellectus agens* and *intellectus patiens.* The former perished with the body and involved the action of the senses, imagination, and memory; the latter, separable from the body and eternal, gives that knowledge form. Reid's classification of the intellect is perception by the senses, memory, conception, abstraction, judgment, reason. To these Stewart added consciousness, attention, imagination, and association of ideas. Sir William Hamilton adopted the division into six faculties: (1) the presentative faculty, or self-consciousness; (2) the conservative faculty, or memory proper; (3) the reproductive faculty; (4) the representative faculty, or imagination; (5) the elaborative faculty, or power of comparison; and (6) the regulative faculty, or the cognition of the instinctive notions of the intellect, as space, time, causation, &c. This classification has remained fundamental in the psychology of common sense. Other classifications of the intellect are memory and reason.

Intention. In the interpretation of legal documents the intention of the maker must receive effect. When the language is clear and unambiguous, such intention is to be ascertained only from the document itself. External evidence may sometimes be admitted to explain a latent ambiguity, however, as when it is disputed which of two persons a testator intended to benefit.

Intercellular Spaces of Plants, the spaces formed by partial separation of the cells as these develop to their adult shape and dimensions. They contain air, and form a continuous system communicating with the outer atmosphere through the stomata and lenticels; their principal function is ventilation of the living tissues, and they also add to the buoyancy of water-plants (in which they are particularly well-developed).

In'terdict, an ecclesiastical censure in the Roman Catholic Church, the effect of which, taken in its most extended sense, is, that no kind of divine service is celebrated in the place or country under the sentence; the sacraments are not administered, the dead not buried with the rites of the Church. This interdict is called *real* or *local,* whilst the personal interdict regards only one or more persons. Gregory VII, though not the inventor of this engine of ecclesiastical power, used it oftener and more tyrannically than any of his predecessors. The eleventh century was pre-eminently the century of interdicts, but they gradually lost power; and when Paul V laid Venice under an interdict in 1606, the churches were not closed nor divine service interrupted, and only a minority of the bishops acknowledged it. The interdict must be announced, like the excommunication, in writing, with the causes, and is not to be imposed until after three admonitions. The penalty of disobedience to an interdict is excommunication. Writers of the Gallican Church say that the Pope has no right to lay France under an interdict, and the Parliaments refused to register them. Interdicts are not to be confounded with the simple *cessatio a divinis,* or the disuse of religious ceremonies, which takes place when a church has been polluted, for example, by a murder committed in it.

Interdict (Lat. *interdicere,* to forbid), in Scots law, an order of the Court of Session, or of a subordinate court, for stopping or prohibiting a person doing an act complained of as unlawful or wrongful. In the Court of Session the interdict is obtained on presenting a note of suspension and interdict to the lord ordinary on the bills; in the subordinate courts by a summary petition to the inferior judge. It corresponds to what is termed in England a writ of injunction (i.e. ' preventive ' injunction). See *Injunction.*

Interest is the consideration paid to the owner of purchasing power for its temporary use. This consideration must vary with the risk the owner runs of the loss or depreciation of the capital lent, and thus contains an element of insurance. In early times, when loans were sought, not for productive purposes, but from the actual need of help to avoid famine or disaster, the risk run by the lender might be great, and the interest proportionately high in the best of cases. He would also be tempted to exploit the borrower's difficulties to the full. Money-lending thus acquired an evil reputation, which was reflected in current legislation. Aristotle regarded money as unproductive, and interest, the propagation of money out of money, as contrary to nature. The Christian Fathers adopted his arguments and added others in vehement attacks against the exacting of interest, and in 1311 the Council of Vienna formally forbade it between Christians. It was not until the sixteenth century that the productiveness of loans applied to agriculture, trade, and industry began to be recognized as legitimizing interest.

The attack had always been against interest paid to another person. That the owner of capital who put it into his own industry or agriculture should earn interest on it was taken for granted. It was not until the end of the eighteenth century, with the massing of industrial capital, that the question arose of the justification for interest as an element in the profits of industry. The justification was claimed on various grounds: that a worker furnished with elaborate machinery was made more productive, and that the reward of the increased productivity belonged to the capital which had ' earned ' it; that the capital was used and its use must be paid for; that the capital was the product of abstinence, and without a prospective reward the abstinence would not be exercised; that capital was accumulated labour and entitled to its reward; that interest was the reward of the performance of the necessary function of investment. The Socialist criticism of interest represents it as the product of the exploitation of his position of advantage by the owner of capital, who uses his position to filch from the workers a part of the product of their labour. This, however, overlooks the fact that there is competition between lenders as well as borrowers, and that the customary rate of interest is determined by the relative needs of the investing classes on the one hand, and the capital-using classes on the other. A survey of the course of the rate of interest on State securities in the past half-century shows this. In the thirty years of peace from 1871 to about 1900 the effective return on Consols sank from 3½ to 2½ per cent, French *rentes* from 5¾ to 3 per cent, Prussian State loans from 5 to 3 per cent, and American State securities from 6 to 2 per cent. The destruction of capital in the Boer War, the Spanish-American, and Sino-Japanese Wars, &c., sent up the rate at the beginning of the present century, but there was no very substantial change until 1914. The calamitous destruction of the European War more than doubled the rate of interest.

Interference, in physics, the name given to the effect at a point through which two or more trains of waves pass simultaneously. It is an effect to be seen on the surface of liquids over which waves are passing; the effects of interference are heard in sound waves; and many beautiful effects are caused by the interference of light waves. Striking contrasts are produced when two equal sources send out waves of the same length and amplitude. At points equidistant from the two sources the waves arrive in the same phase, i.e. their crests, for example, arrive at the same moment, and a wave of double amplitude or height is produced. At other points on each side, the two waves arrive in opposite phase, i.e. the crest of one wave reaches the point at the same instant as the hollow of the other wave, and the resultant effect at the point is zero vibration. The two prongs of a tuning-fork act as generators of sound waves of equal length and amplitude, but of opposite phase, and if a sounding fork is rotated in a vertical position in front of the ear, four positions of the fork may be distinguished for which no sound is heard. The two sets of waves interfere to produce silence. An analogous effect is produced by waves of light by means of Fresnel's biprism. A narrow slit in front of the biprism is illuminated by monochromatic light, and the prism by refraction produces two trains of waves which cause interference effects on a screen or in an eyepiece, a series of bright and dark bands being seen. The central band is bright, since it is equidistant from the two virtual sources or slits formed by the biprism, and the waves arrive at the central band in the same phase. The bands at either side are dark, being caused by light waves which arrive in opposite phase; the paths by which the light reaches these bands differ in length by half a wave-length. The next outer bands are bright, and the paths to each from the two sources differ by a whole wave-length; and so on. A similar effect is produced when a very weak plano-convex lens is placed on a plane glass surface and illuminated by monochromatic light. The interference of the waves which are reflected to the eye from the two surfaces in contact gives rise to alternate bright and dark concentric rings known as Newton's rings. When the wave trains are not of the same wave-length, the effects differ in some respects from those just described. If two tuning-forks, organ-pipes, or piano strings differ slightly in pitch, they will, when sounded together, give rise to a series of beats or accentuated sounds each of which is caused by the simultaneous arrival at the ear of two waves in the same phase. The number of beats heard in one second is equal to the difference between the frequencies of the two sounding bodies. The production of 'beats' with Hertzian waves is employed in the process of heterodyne reception in wireless telegraphy. When the composite waves of sunlight are in a position to interfere, many beautiful colour effects are produced. The two sets of waves reflected to the eye from the outer and inner surfaces of a soap bubble give rise to the well-known colours of the bubble. The same explanation applies to the colours seen when a thin film of oil spreads over the surface of a sheet of water. A similar effect is observed when an internal rupture occurs in a block of glass or ice. Fresnel's biprism fringes and Newton's rings are applied in the laboratory to measure the wave-length of light. Interference colours may be used to test the planeness of glass surfaces. The bands are also employed in an instrument called an interferometer for measuring lengths in terms of the wave-length of light. Michelson thus found that the standard metre contained 1,553,163·5 wave-lengths of the red light emitted by cadmium.

Interglacial Beds, geological deposits belonging to some epoch in a glacial period when the climate became ameliorated and the ice-sheets shrank back or almost entirely disappeared. See *Glacial Epoch*.

Interla'ken ('between the lakes'), a village in Switzerland, in the canton and 26 miles S.E. of Berne, beautifully situated near the left bank of the Aar, between the lakes of Thun and Brienz, much resorted to by tourists. Pop. 4000.

In′terlude, originally an entertainment exhibited on the stage between the acts of a play, or between the play and the afterpiece, to amuse the spectators while the actors rested or shifted their dress, or the scenes and decorations were changed. In England dramas known as interludes preceded the rise of the regular drama. (See *Drama.*) The name is also given to a brief piece of church music, prepared or extempore, for the organ, and played after each stanza except the last of a metrical psalm or hymn.

Intermezzo (in-tėr-met′so), a short musical piece, generally of a light sparkling character, played between the parts of a more important work, such as an opera, drama, &c. Pieces intended for independent performance are sometimes designated by this name by the French and Italians. A famous intermezzo occurs in Mascagni's *Cavalleria Rusticana,* and another favourite one is to be found between the second and third acts of Wolf-Ferrari's *Jewels of the Madonna.*

Internal - combustion Engines are prime movers which are driven by the energy obtained from the combustion of mixtures of gas (or vapour) and air. Internal-combustion engines (hereafter referred to as I.C. engines) were invented about 1820 by a clergyman, the Rev. W. Cecil (Camb. Phil. Soc.). He made an engine which worked by the explosions of a mixture of hydrogen and air. W. Barnett in 1838 suggested the compression of the mixture before firing it, to increase its explosive power. Lenoir overcame the most serious of the practical difficulties, and in 1860 produced a commercial engine. In 1866 Otto and Langen introduced a superior type (Inst. Mech. Engineers, 1875). Otto introduced the engine working on the so-called 'Otto' cycle about 1876. This cycle was really the suggestion of Beau de Rochas.

In 1881 J. Dowson introduced 'producer gas' (q.v.) as a fuel, and in 1895 B. H. Thwaite showed that gas-engines could be run on the 'waste gases' from blast-furnaces (q.v.). R. Diesel in the same year introduced a new type of engine, which has found favour as an oil-engine. In the development of large gas-engines, the most striking innovations are the invention of the two-stroke cycle by Sir Dugald Clerk (Society of Arts, 1905); the development of the two-stroke engines, the Koerting (of German origin) and the Oechelhauser (another German engine); and the use by Fullagar in recent years of 'oblique connecting-rods' between diagonally-opposite pairs of opposed pistons. The Oechelhauser engine, manufactured before the European War by the Machinenfabrik Ausberg Nuremberg (M.A.N.) Gesellschaft, is an opposed-piston engine. The 'Still' engine is a recent type which uses steam on one side of the piston and gas on the other. It is now being constructed in single-engine units of 1200 b.h.p.

As an example of the performance of a medium-power gas-engine installation, figures may be quoted for the installation at the works of the Cargo Fleet Iron Company, Ltd., steel and iron manufacturers, Middlesborough. These figures have been specially contributed by the company. The installation consists of two 600-h.p. gas-engines coupled to generators for generating electric power, and two 1600-h.p. gas-engines for running blowing-engines. The power-units are tandem-cylinder, double-acting gas-engines driven by blast-furnace gas. They are direct-coupled to D.C. generators of about 350 kilowatts capacity each. Each engine takes about 5400 gallons of fresh water per hour for cooling purposes, which is returned from a cooling-tower with a 3 per cent loss. The consumption of lubricating oil averages 3½ gallons per day of twenty-four hours for all lubricating purposes, including the oil taken by the cylinders. The ignition is by induction-coil on one engine, and by 'magneto' on the other. Two men are in attendance on the power-units. The units driving the blowing-engines are tandem-cylinder, double-acting engines having back piston-rods, direct-coupled to 92-inch diameter air-blowing cylinders. The output of each engine is 25,000 c. feet of free air per minute, delivered against a blast-pressure of 10 lb. per square inch. The engines develop 1 i.h.p. hour on 8400 B.Th.U. The gas, being blast-furnace gas, is of low calorific value —some 100 B.Th.U. per cubic foot. At this figure the gas-consumption of the engines works out at about 84 c. feet of gas per i.h.p. hour. The consumption of lubricating oil is 4 gallons per day of twenty-four hours for each gas-engine and blowing-cylinder. The water-consumption is about 14,400 gallons per hour per engine. In 1917 the blowing-engines ran for 7932 hours, making the time off duty from various causes 828 hours per annum. This performance occurred after the plant had been running for four years. Two men are in attendance on the blowing-engines. The gas used leaves the blast-furnaces and enters the gas-washers at 300° to 500° F., and contains 2 to 4 grammes of dust per cubic metre. After passing through the gas-washer, the dust content is reduced to 0·006 to 0·008 gramme per cubic metre, and the temperature to 70° F. 80 gallons of sea-water per minute are used in the gas-washers. A typical analysis of the blast-furnace gas is:

Nitrogen ..	60·00 per cent.
Carbonic acid ..	11·00 „
Carbon monoxide	27·00 „
Hydrogen ..	2·00 „
Calorific value ..	101 B.Th.U. per cubic foot.

The circulating water for cooling the engines enters at about 60° F. and leaves at a temperature between 100° and 120° F. The pistons and piston-rods take some 19 per cent of the total cooling-water used.

The present practice of the National Gas Engine Company is to use tandem cylinders on the Otto cycle in the large-sized engines.

The most important cycles of operation upon which modern I.C. engines work are the Otto, or constant-volume, cycle, and the Diesel, or constant-pressure, cycle.

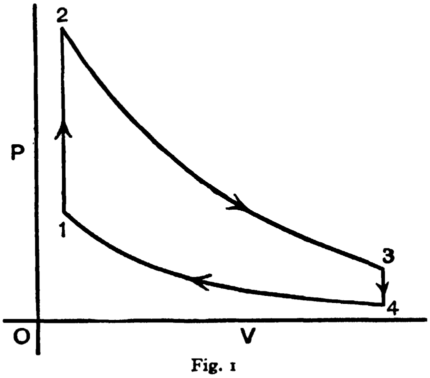


Fig. 1

Otto Cycle.—(1) A combustible mixture of gas and air is sucked into a cylinder at approximately atmospheric pressure. (2) It is compressed, approximately adiabatically, to a small volume at a high pressure and a fairly high temperature. (3) It is exploded, and the pressure rises more or less abruptly according to the speed of the explosion. (4) The high-pressure mixture (no longer the same, chemically, as it was in stages 1, 2, and 3) expands approximately adiabatically, doing external work and getting cooler in the process. (5) The burnt mixture at a low pressure and a fairly low temperature is expelled from the cylinder into the atmosphere.

In this cycle we get one explosion per two revolutions of the engine, and the engine is known as a four-stroke engine, i.e. four strokes go to each complete cycle of events. The programme is repeated in the next two revolutions of the engine, and so on indefinitely. The nearest ideal cycle to this one is that represented in fig. 1. The theoretical efficiency of this cycle is given by

$$\eta = 1 - \left(\frac{1}{r}\right)^{\gamma - 1},$$

where η is the efficiency, r the ratio of expansion, i.e. the ratio of the cylinder volume to the clearance volume, and $\gamma = 1{\cdot}4$.

Diesel Cycle.—This cycle differs from the previous one in the much higher pressure that is reached before the fuel is injected, and in the burning of the fuel relatively slowly at constant pressure instead of nearly instantaneously at constant volume. (1) A charge of *air* is sucked into a cylinder at approximately atmospheric pressure and temperature. (2) It is highly compressed, more or less adiabatically, so that its temperature is sufficiently high for oil to burn when squirted into it. (3) By means of a pump, or air at a pressure higher than compression, oil is squirted into the cylinder and burns. While burning proceeds, expansion is allowed to take place so that the pressure does not rise, i.e. the heat energy of combustion, except such as is used in the expansion referred to, goes into the gas at constant pressure. (4) When combustion is complete, the burnt mixture is allowed to expand more or less adiabatically, thereby doing work and getting cooler. (5) When the piston gets to the end of its stroke, the cylinder is connected to the atmosphere, and the contents of the cylinder, at a fairly low pressure and temperature, are expelled from the cylinder into the atmosphere during the ensuing stroke.

The ideal cycle nearest to this one is shown in fig. 2. The theoretical efficiency of this cycle is given by

$$\eta = 1 - \frac{1}{\gamma}\left\{\frac{\rho^{\gamma} - 1}{\rho - 1}\right\}\left(\frac{1}{r}\right)^{\gamma - 1},$$

where η is the efficiency, ρ the expansion ratio *at constant* pressure, r the total expansion ratio, and $\gamma = 1{\cdot}4$. It can be shown that

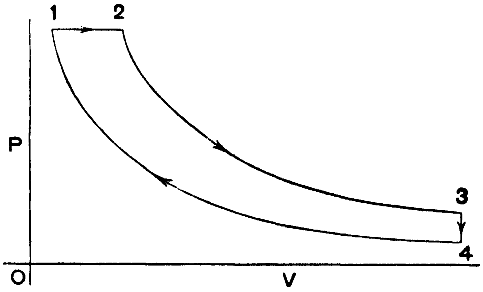


Fig. 2

$$\left\{1 - \left(\frac{1}{r}\right)^{\gamma - 1}\right\}$$

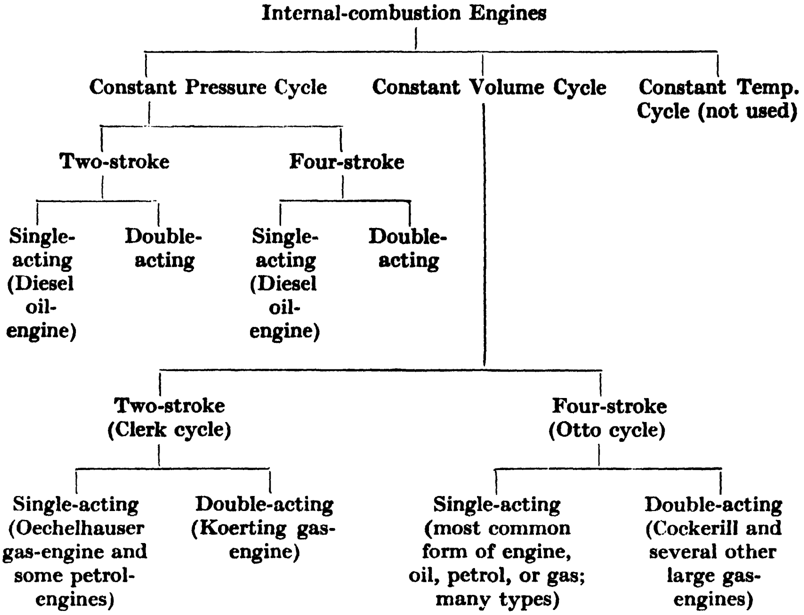
is greater than

$$\left\{1 - \frac{1}{\gamma}\left\{\frac{\rho^{\gamma} - 1}{\rho - 1}\right\}\left(\frac{1}{r}\right)^{\gamma - 1}\right\}.$$

This result would suggest that a higher efficiency is attainable with an Otto engine than with a Diesel. But in practice a very much greater ratio of compression can be used in the Diesel than in the Otto engine, for the reason that in the Diesel engine a non-explosive substance—pure air—is compressed. In consequence of this the Diesel is more, not less, efficient than the Otto engine, in spite of its mechanical efficiency being somewhat less.

A simple engine, working on either of these cycles, receives energy during one stroke out of four. Such engines are called 'four-stroke' or 'two-cycle' engines.

Modern Engines.—Practical engines may be classified in regard to the fuel they use and the speed they run at; thus we get gas-, oil-, or petrol-engines, and high- and low-speed engines. Broadly speaking (there are many exceptions), gas- and oil-engines are low-speed engines, and petrol, high-speed ones. The diagram above,


Internal-combustion Engines
Constant Pressure Cycle
Constant Volume Cycle
Constant Temp. Cycle (not used)
Two-stroke
Four-stroke
Single-acting (Diesel oil-engine)
Double-acting
Single-acting (Diesel oil-engine)
Double-acting
Two-stroke (Clerk cycle)
Four-stroke (Otto cycle)
Single-acting (Oechelhauser gas-engine and some petrol-engines)
Double-acting (Koerting gas-engine)
Single-acting (most common form of engine, oil, petrol, or gas; many types)
Double-acting (Cockerill and several other large gas-engines)

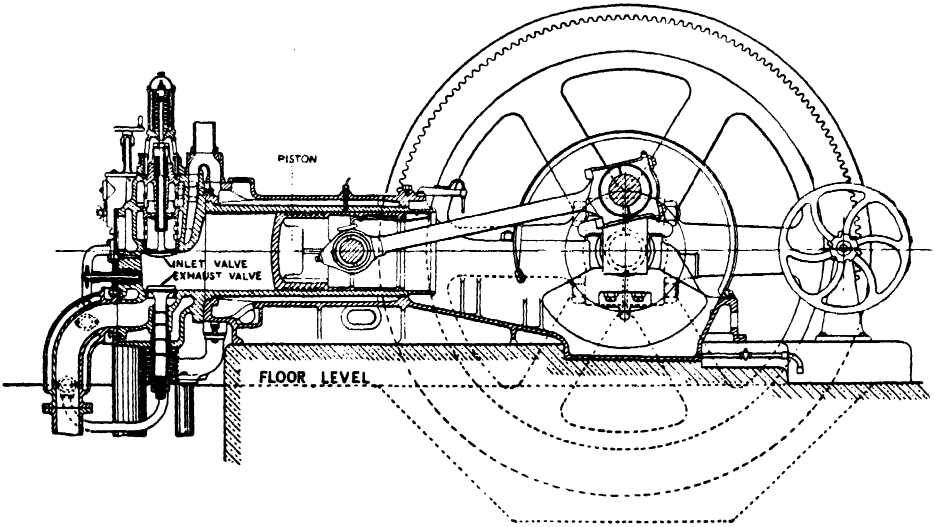


Fig. 3.—Crossley Gas-engine

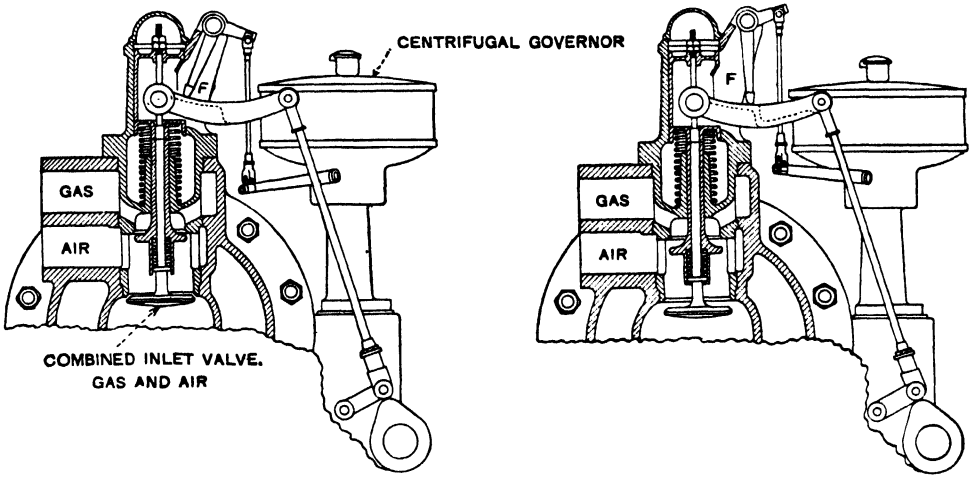


Fig. 4.—Crossley Variable-admission Governing. F, Movable fulcrum, controlled by centrifugal governor.

taken from Wimperis's *Internal Combustion Engines,* shows very clearly the relationship between the different engines.

(1) *Crossley Gas-engine.*—Fig. 3 is a sectional elevation of a standard Crossley gas-engine working on the Otto cycle. Suppose the engine is at the beginning of the outward (suction) stroke. The exhaust valve is closed, the inlet valve open. A charge of gas and air is thus admitted to the cylinder. The inlet valve now closes (the exhaust continuing closed) and the compression stroke takes place. At the moment of crossing the 'dead-centre', outwards again, the charge is fired by a carefully-timed electric spark derived from a magneto. Explosion takes place nearly instantaneously and the pressure rises very quickly. The ensuing outward stroke is the 'expansion' or driving stroke, all the valves being closed. At the end of the expansion stroke the exhaust valve lifts, and the following inward stroke is the scavenging stroke, in which the 'dead' products are swept out of the cylinder through the exhaust valve. Fig. 4 shows very clearly the construction of the inlet valves, and how governing is effected on the 'variable-admission' principle.

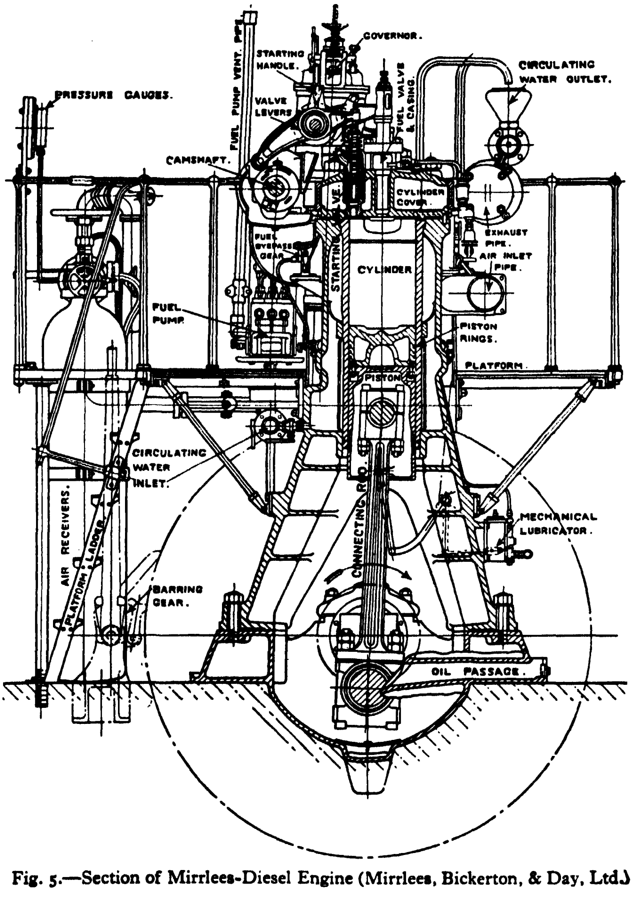


Fig. 5.—Section of Mirrlees-Diesel Engine (Mirrlees, Bickerton, & Day, Ltd.)

(2) *Mirrlees-Diesel Engine.*—A typical example of a modern Diesel engine is that manufactured by Mirrlees, Bickerton, & Day, Limited, Stockport. The engine is illustrated in fig. 5, which shows a sectional end view of the engine. The valves are indicated in fig. 6 by the letters E, A, and F (exhaust, air, fuel).

We shall describe the cycle from the moment when the compression stroke is beginning. Valves E, A, and F are all closed and the piston comes up, compressing the cylinderful of air to a very small volume (about $\frac{1}{12}$ of its original volume). The pressure at the end of compression is about 500 pounds per square inch, and the temperature of the air about 950° F.

The valve F opens after the piston has passed the dead-centre, and oil is sprayed into the cylinder *by compressed air*. Combustion takes place, and the pressure *is maintained* for a little while as the piston moves outwards (see fig. 7). The expansion stroke takes place with valves E and A closed. At the end of the expansion stroke the valve E opens, and the charge escapes to atmosphere. The exhaust stroke now takes place with E open and A and F closed. Valve E closes and A opens, and the suction stroke begins and ends with a cylinderful of air, ready for the next cycle.

The compressed air is got from a small air compressor coupled to the main crank shaft.

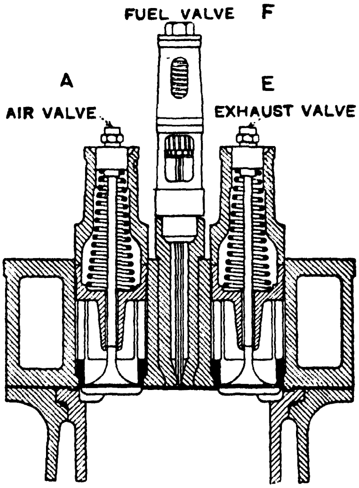


Fig. 6.—Details of Valves (Mirrlees, Bickerton, & Day, Ltd.)

The exhaust and air valves are interchangeable and easily renewable. The fuel valve is simple. The set is shown in fig. 6.

The engine is started by running it on compressed air. A starting lever throws into action the starting valve (fig. 5), and cuts out the fuel valve. The engine is 'barred' round until the starting valve is open, and then it starts on the compressed air and runs as a compressed-air motor on a stored supply of compressed air. When sufficient speed is attained, the starting lever is thrown into the running position, which cuts out the starting valve and leaves it permanently closed, and cuts into action the fuel valve. The engine now picks up speed, running as an oil-engine. Fig. 7 is an actual indicator diagram of this type of engine.

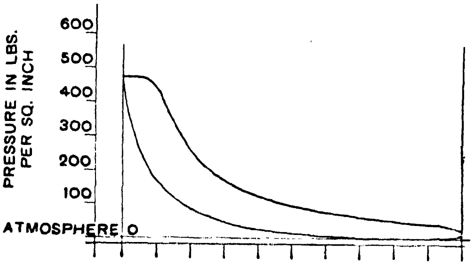


Fig. 7.—Indicator Diagram of Diesel Engine (Mirrlees, Bickerton, & Day, Ltd.)

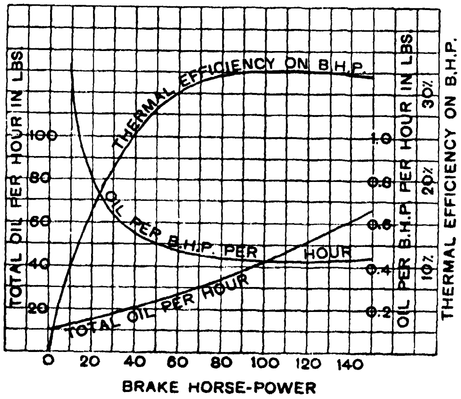


Fig. 8.—Performance Curves for Crossley (Otto) Oil-engine of 117 b.h.p. (Oct. 1918; test by Burstall)

Many manufacturers construct oil-engines on the Otto cycle. Fig. 8 is made from results of a test by Professor Burstall on a 117-b.h.p. Crossley 'cold starting' oil-engine (Oct., 1918). The calorific value of the oil used was 18,500 B.Th.U. per pound. Fig. 9, taken in this test, is a typical indicator diagram for an Otto oil-engine.

Messrs. Beardmore & Co. have taken up the development of the Diesel engine for mercantile marine purposes in collaboration with the Italian firm of Franco Tosi, of Legnano. The engine they manufacture is a four-stroke single-acting engine.

They have standardized a series of cylinders capable of giving 40, 50, 100, and 210 b.h.p. each at a moderate rating of effective pressure and piston speed. The largest standard six-cylinder engine has therefore a continuous rating of 1250 b.h.p. Each cylinder has a bore of $24\frac{7}{16}$ inches, the stroke being $38\frac{3}{8}$ inches. The piston speed at 125 r.p.m. is 800 feet per minute. The cylinder heads contain, as usual, the valves, which are as follows: (*a*) the air starting valve; (*b*) the relief valve; (*c*) the fuel-injection valve; (*d*) two combined inlet and exhaust valves; (*e*) two ‘ director valves ’. The director valve is an ingenious device which would enable one combined inlet and exhaust valve only to be used if this were considered desirable. The following description of one of the pair of combined valves will be sufficient. One end of the port opens through the cylinder head into the cylinder, and the other end into a two-way passage, one the air-passage and the other the exhaust-passage. The director valve closes one or other of these passages, leaving the one not closed in connection with the cylinder. An ordinary mushroom valve closes the end of the cylinder-head port entering the cylinder (see fig. 10).

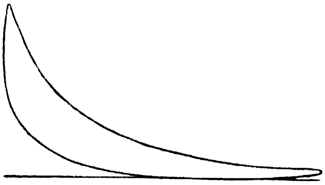


Fig. 9.—Indicator Diagram of Crossley (Otto) Oil-engine

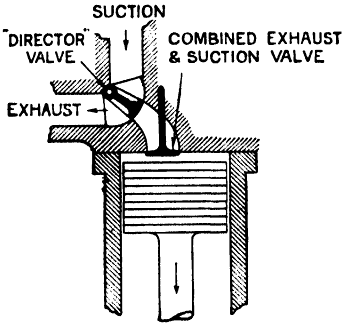


Fig. 10 —Beardmore-Tosi Valves. Beginning of Firing-stroke, Piston top-centre. Both closed

The sequence of operation of these valves is evident. Though one of these combined valves would be thoroughly sufficient, two are used for practical reasons. The fuel-injection valve is of the ‘ needle ’ type, and has no packing gland. The pressure of the compressed-air supply for fuel injection is about 1000 pounds per square inch. For reversing the engine double cams are provided, one set for ‘ going ahead ’ and one for ‘ going astern ’, but instead of moving the cam shaft bodily, the cam rollers only are moved to register with their respective cams. The engine is started on compressed air at 300 pounds per square inch pressure in the following sequence: 6 cylinders on air, 3 on air and 3 on fuel, and 6 on fuel. During a six-hour full-load trial the following results were obtained with a Beardmore - Tosi engine: i.h.p., 1766; b.h.p., 1332; r.p.m., 129·6; mechanical efficiency, 75·5 per cent; mean effective pressure, 76 pounds per square inch; fuel consumption, 0·411 pounds per b.h.p. hour; blast-air pressure, 1030 pounds per square inch.

Design. — The details of high - speed petrol - engines are quite different from those of low-speed gas- or oil-engines, so much so that few gas-engineers are equally facile in designing either type. For detailed information the special treatises must be consulted, but the following *general principles* govern the design of both classes.

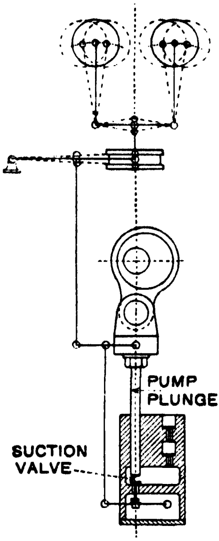


Fig. 11. — Governing by Regulation of the Fuel Pump. (Mirrlees, Bickerton, & Day, Ltd.).

1. *The Admission of Fuel.*—The gas for a gas-engine is led from the mains by a pipe leading to the breech of the engine. In oil-engines the fuel falls to the vaporizer level, or may be injected by a pump. This latter arrangement is used in the Diesel engine. The pump delivers oil at a pressure of from 640 to 1000 pounds per square inch to a fuel-injection valve (fig. 6), through which it passes as a spray into the cylinder and burns gradually, thus maintaining a constant pressure in the cylinder during the first part of the expansion. A pump can be used as a means of governing the engine (see fig. 11). With light oil-engines working on the Otto cycle, or with petrol - engines, a carburettor is used to vaporize the petrol. The mixture of petrol-vapour and air is drawn into the engine as in a gas-engine. A common carburettor is shown in the article *Motor-car Engines.*

2. *The Ignition of the Charge.*—The charge is

usually ignited by causing a correctly-timed electric spark to take place in it. The spark is generated by a *magneto* (q.v.) or by an *induction coil* (q.v.), with one or two accumulator cells (see *Secondary Cell*). The ignition is sometimes done by an ignition or hot tube. A tube which is kept nearly red-hot has ‘ controlled access ’ to the cylinder. At the moment when ignition should take place a valve allows the compressed mixture to enter the hot tube, where it ignites and explodes.

These remarks apply only to engines working on the constant-volume principle (Otto cycle). In the Diesel engine the fuel is self-igniting, the temperature at the end of compression being high enough to ignite the fuel, and it burns relatively slowly.

3. *Cooling the Combustion Chamber and Cylinder.*—The temperatures reached during explosion and combustion are very high, and the cylinder and combustion chamber must be kept cool. Water is used for this purpose, and is circulated round the cylinder and combustion chamber as seen in figs. 3 and 5. Such a cylinder is described as being ‘ water-jacketed ’.

4. *Mechanical Design.*—In the four-stroke, single-cylinder engine energy is supplied to the engine during one stroke out of four. The twist applied to the crank shaft is therefore very irregular. On the other hand, the demand for energy by the ‘ load ’ is usually fairly constant, so that the engine has to be fitted with a large fly-wheel to act as a reservoir of energy. During the explosion stroke the fly-wheel speeds up a little, and during the following three strokes its speed falls. The ratio of the extreme variation of speed to the mean speed is called the ‘ cyclic irregularity ’. It is about 4 per cent for ordinary engines, but must be less than 0·7 per cent for gas-engines to drive alternators in parallel. One great advantage of a multiple-cylinder engine is that the twist applied to the crank shaft can be kept much more uniform, and therefore a smaller fly-wheel can be used.

The problem of *balancing* the parts of the engine and providing for uniformity of twist as far as possible is perhaps the principal problem of the mechanical design. Uniformity of twist is approached by the use of more than one cylinder and of a two-stroke cycle. The simplest case of balancing occurs in the fly-wheel. If it is light on one side, an additional mass is attached to one of the spokes or the rim on the other side, so that the resultant centrifugal force is zero, and the bearings only have to take the dead-weight of the fly-wheel. The piston should be balanced as far as possible, but this is a more difficult problem as it has a reciprocating motion. It cannot be completely balanced in a single-piston engine. In Fullagar's engines the pistons are balanced thus (fig. 12): There are four pistons working in two cylinders (A B), (A′ B′). In the figure A and B are approaching each other and compressing the charge in *c* while A′ and B′ are receding from each other under the explosion in E. A is coupled to B′ and B to A′ by means of oblique rods.

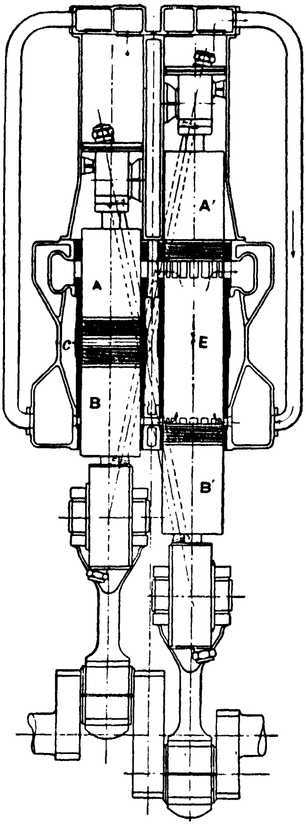
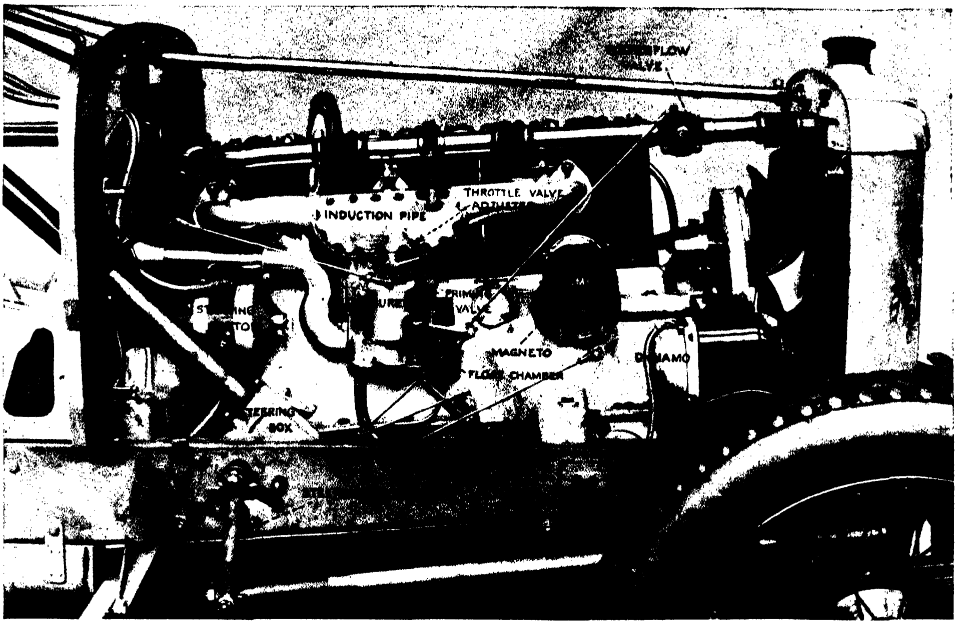


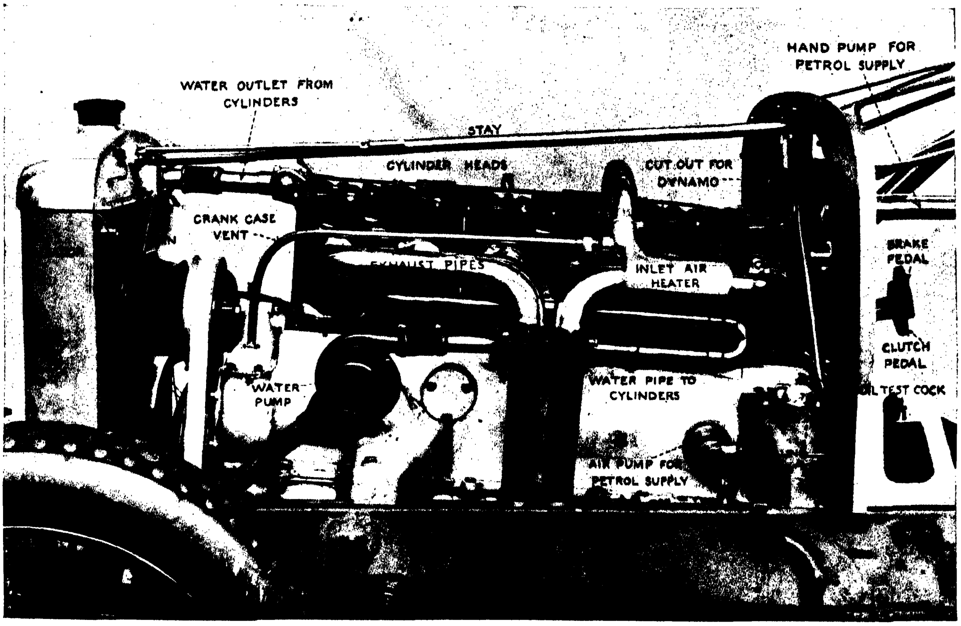
Fig. 12.—Arrangement of Cross-connected Pistons in Fullagar's Engine

The inertia force of A exactly balances that of B′; similarly with B and A′. Further, an explosion takes place during every half-revolution in such a two-cylinder engine, so that the twist applied to the shaft can be made nearly uniform by using three of these two-cylinder elements on one crank shaft. The crank shaft and fly-wheel are therefore relatively light. The connecting-rods are the most difficult parts to balance, theoretically. As a first approximation, it is usual to replace the rod by a massless one, and to add a mass m_1 to the cross-head, and a mass m_2 to the crank pin, where $m_1 + m_2 = M$, the total mass of the rod, and m_1, m_2 are in inverse

INTERNAL-COMBUSTION ENGINES—II. See also Plate I



Induction Side



Exhaust Side

DAIMLER 45 H.P. 6-CYLINDER ENGINE

proportion to the distance of the centre of gravity of the rod from either end.

Governing contrivances are fitted to the engine to ensure that it runs as nearly as possible at constant speed under varying conditions of applied load within the capacity of the engine. The speed of the engine is brought into play just as in the steam-engine, namely, by the variations in the centrifugal force on a pair of rotating balls. For instance, when the speed rises, the balls (fig. 11) fly outwards and the fitting A moves upwards, and vice versa. The movements of this fitting A are used to control the engine in the following ways: (1) by cutting off the whole of the fuel-supply for one or more cycles; (2) by reducing the amount of fuel used per cycle, leaving the air-supply untouched; (3) by reducing the amount of both fuel and air, keeping the proportion of fuel to air the same, or by causing the ignition to come later, or to be cut off altogether.

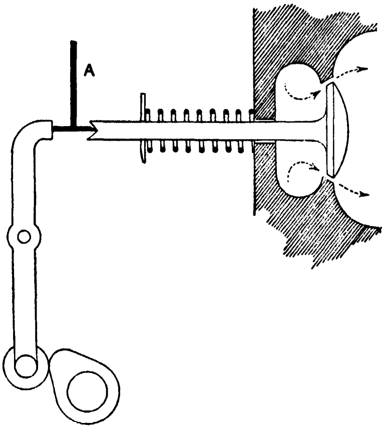


Fig. 13.—The 'Hit-and-miss' Governor Principle

The first of these arrangements is a very common one, and is called the 'hit-and-miss' principle. It is illustrated in fig. 13. The position of the part A is controlled by the governor. Motor-car engines are usually governed by hand by means of the throttle.

Fuel Consumption.—The gas consumption of a gas-engine varies a great deal with the load, the nature of the gas, i.e. its calorific value, &c., and the size of the engine. Roughly speaking, the brake horse-power efficiency ranges from about 20 to 33 per cent, the smaller value being for small engines on full load or large engines on light load. From these figures an estimate can be made of the approximate gas consumption; for instance, if we take a 30-b.h.p. engine working on town gas at a calorific value of, say, 500 B.Th.U. per cubic foot, we get, for the gas consumption in 1 hour,

$$\frac{30 \text{ (b.h.p.)} \times 2545 \text{ (B.Th.U. in 1-h.p. hour)}}{0{\cdot}20 \text{ (efficiency)} \times 500 \text{ (calorific value)}} = 763 \text{ c. feet,}$$

i.e. a consumption per b.h.p. hour of

$$\frac{763}{30} = 25{\cdot}4 \text{ c. feet,}$$

assuming the engine is running at full load at a brake efficiency of 20 per cent.

The higher efficiency of 33 per cent is reached in engines of some 2000 b.h.p. For oil-engines a fairly representative figure is ½ pound of oil per b.h.p. hour, though this figure, like the corresponding figure for gas-engines, varies a great deal with the size of engine, the relative load, nature of oil, and so on. A reasonable figure for petrol-engines is about ¾ pound of petrol per b.h.p. hour, or, say, ⅔ pint per b.h.p. hour. These figures are only given as guides in general estimates; they may vary in as great a proportion as 2 : 1, depending on the circumstances of each case.—BIBLIOGRAPHY: H. E. Wimperis, *The Internal Combustion Engine*; A. P. Chalkley, *The Diesel Engine*; G. Supino, *Diesel Engines* (translated by A. G. Bremner and J. Richardson); G. A. Burls, *Aero-Engines*. For details of actual engines, see makers' literature.

International, The Socialist. The first attempt at the international organization of the Socialist and Labour movement was the 'International Association of Working Men', founded in London in 1864 under the leadership of George Odger, Randall Cremer, and, among others, Karl Marx, whose inaugural address ended with the slogan "Proletarians of all countries, unite!" The Association was definitely revolutionary, but not at first definitely socialist; its aim was the conquest of power by the proletariat. The part played by the Association in the Paris Commune led to wholesale secessions on the part of British trade unionists and to exceptional legislation against its members in France, but the Association was finally shattered by differences between its socialist and anarchist elements. Its last European Congress was held at Geneva in 1873. Its head-quarters were moved to America, where, in 1876, it was dissolved.

The attention of European Socialists was concentrated in the decade that followed on the building up of strong national parties as the necessary prelude to an effective International. From 1889 onwards international Socialist congresses were held at intervals of two or three years. At the 1900 Congress in Paris the terms of participation were defined so as to include only groups, striving for the attainment of socialism, which admit the need for parliamentary activity, and trade union organizations which, though not participating in the political movement, recognize the need for such activity. At this Congress the International Socialist Bureau was set up as the secretariat and organizing centre of what has since come to be known as the Second International.

The Second International was practically destroyed by the European War. Its famous resolution on the attitude of Socialists in the event of war had been shown to be built upon sand, and it was regarded as discredited by the growing bodies of Socialists who opposed the war. Its bureau, still (1921) adhered to by the British Labour Party, the German Social Democratic Party, and a number of smaller national parties, has been transferred from Brussels to London, M. Camille Huysmans being succeeded as secretary by Mr. Ramsay Macdonald.

The Third, or Communist International, founded at Moscow in March, 1919, was the outcome of the conferences held at Zimmerwald (Sept., 1915) and Kienthal (April, 1916) by Socialist parties and groups opposed to the war. Its second Congress (Moscow, July–Aug., 1920) drew up the Constitution of the Communist International, and laid down twenty-one conditions of membership, of an exceedingly uncompromising character. They require the exclusion from the affiliated national parties of all members who support a 'reformist' policy of political co-operation with capitalist parties; "such avowed reformists" as Turati, Modigliani, Kautsky, Morris Hillquit, Jean Longuet, and Ramsay Macdonald "cannot be tolerated". War is declared on "the Yellow Amsterdam International of Trade Unions". Resolutions of the Communist International or its executive are binding upon affiliated parties: "The Communist International, operating in a period of acute civil strife, must be centralized in a more effective manner than was the Second International". There are numerically strong parties affiliated to this International in France, Germany, and Czecho-Slovakia, but its conditions, especially in regard to the exclusion of moderate elements, are such as large numbers of European Socialists who had left the Second International were not prepared to accept.

A Congress of the parties thus left without international affiliation met at Vienna in Feb., 1921, and formed an 'International Working Union of Socialist Parties', with the object of recreating an International inclusive of all Socialist parties. The British Independent Labour Party, the French Socialist Party, the German Independent Socialists, the Austrian, German-Czech, Hungarian, and Swiss Socialist Parties, and the Russian Mensheviks and Social Revolutionaries took part in the Congress, and the Union has since added to its ranks a number of other national parties of the type which aims at "something more drastic than reform, and less disturbing than revolution". — BIBLIOGRAPHY: Th. Kirkup, *History of Socialism*; Villetard, *Histoire de l'Internationale*; E. Laskine, *L'Internationale et le Pangermanisme*.

International Labour Legislation. The regulation of the conditions of labour is welcomed by the better employers as preventing forms of competition which they rightly shrink from adopting. With the growth of this regulation it was, however, realized that it is not sufficient that it shall be national; evil conditions removed in one country may handicap its industries in competition with foreign rivals. Opinion thus grew in favour of international regulation, and the movement towards this was strengthened as trade unions developed international organization. The earliest initiative was taken by the Swiss Federal Government in a circular letter sent in 1881 to the various industrial countries of Europe. It was, however, not favourably received. In 1885 the German Social Democrats demanded that their Government should take steps to further the international establishment of the ten-hour day, and prohibition of night-work and of the employment of children under fourteen. A second circular letter sent out by the Swiss Government in 1889 met with more success, and an International Conference was held in Berlin in March, 1890, which made recommendations in regard to work in mines, Sunday work, and children's, young people's, and women's employment.

In 1900 a Congress took place in Paris to establish an International Association for Labour Legislation. The Association was constituted in Basel in 1901, and devoted its attention in the first place to inquiries into the industrial night-work of women and into the dangerous industries, notably those using lead and white phosphorus. On its instigation the Swiss Government called an International Conference at Berne in 1905, as a result of which the Berne Conventions of 26th Sept., 1906, were drawn up prohibiting the industrial employment of women at night, and the use of white phosphorus in the manufacture of matches. This material had been responsible for one of the most terrible industrial diseases, phosphorus necrosis or 'phossy jaw'. A number of countries adopted the conventions at once, and, owing to the energy of the national sections of the Association, they are now observed by practically all civilized countries.

Under the Versailles Treaty an International Labour Organization was set up as a constituent part of the League of Nations, to promote the regulation of working hours, the prevention of unemployment, the 'living wage', protection against sickness and accident, the protection of women and children, and labour protection generally on international lines. The organization consists of a General Conference, a Governing Body, and an International Labour Office (I.L.O.). The General Conference is composed of two Government representatives, together with one representative of employers and one of labour, from each country. The Governing Body of twenty-four members is similarly composed of Government, employers', and workers' representatives; it controls the I.L.O., and prepares for the meetings of the General Conferences. The I.L.O. is the secretariat of the organization.

The General Conference met in 1919 at Washington, and adopted conventions concerning the eight-hour day, unemployment, and the employment of women and children; in 1920 it met at Genoa to deal with the conditions of employment at sea; in 1921 at Geneva, to deal with agricultural questions. The conventions adopted are intended to be made the basis of Government action by the members of the League, and while the League has not even nominal power to compel such action, it may at least be hoped that the conventions will stimulate the international levelling-up of the conditions of labour. —BIBLIOGRAPHY: *Annuaire de Législation de Travail* (issued by the Belgian Office de Travail); *The Labour Year-Book*; H. J. W. Hetherington, *International Labour Legislation*.

International Law has been defined as the rules acknowledged by the general body of the civilized independent States to be binding upon them in their mutual relations. In times past there has been controversy between the *Naturalists*, who maintained that such rules were to be deduced from natural principles inborn in, and as old as, civilized man himself (e.g. Samuel Pufendorf, 1632–94), and the *Positivists* (e.g. Cornelius van Bynkershoek, 1673–1743), who paid respect to such rules only in so far as they embodied practices agreed on by civilized nations, either through custom or by treaty. Since Grotius (1583–1645) it has been held with increasing force that the stream of international law, when broken by the prism of historical investigation, is seen to be composed of waves from both these sources. International law had a Christian origin, and originally it was not conceived of as binding upon any but Christian States. Now States not Christian, but civilized, claim admission to the Family of Nations; and admission is not refused in cases where their sovereign character is unquestionable, and where presumption exists that international law will in the government of international relations be held paramount.

It is by international law that the relation of States to the family of nations is determined, e.g. to what extent Hyderabad, Iceland, the Papacy, Ireland, are or are not members of it. It determines the nature, force, and scope of treaties. It governs the rights of countries over their own or their protected territories. It gives to each certain rights over the sea and air. In time of war it moderates, with more or less success, the fury of combat; it defines the rights of the neutral Powers *vis-à-vis* the belligerent. It governs by rules the procedure of diplomatic intercourse.

Clearly, before nation States arose international law was an impossibility. In the Middle Ages, States, as we know them to-day, or as the ancients knew them, hardly existed. Then international law was dim, consisting only of a few maritime conventions governing trade in the Mediterranean or the Baltic, or of customs controlling the treatment of emissaries sent by one king to another. During the Crusades we hear of 'consuls' representing European interests in Turkey, Palestine, or the Levant, but little is known of their functions or their privileges. At the Renaissance the great modern States arose. In thinking out a system of regulation for the necessary business which they did with each other, Hugo Grotius won the title of the 'Father of International Law'.

Great as was the ingenuity and practical sense of Grotius, neither he nor other writers gave to posterity an all-sufficient code. It is roughly true to say that the history of international law since his day falls into two, or possibly three, periods. The first may be termed the *period of competition*. Its most characteristic features are to be seen in the sixteenth, seventeenth, and eighteenth centuries. Throughout, the relations of States are determined by the principle of the balance of power. Did Louis XIV, or Napoleon, or any other monarch, or republic, aim at the domination of the rest, a force, formed by the combination of a group of States more powerful, prevented it. In the principle itself there is much commendable, and it is operating still. Its translation into practice was so rough, and the negative character of the results so patent, that there is a tendency to overlook the good to which it gave rise. It did preserve peace on many occasions, and it did give time for international practice to develop on normal and sound lines, crystallizing, as it did so, into international law. This was the time of many international treaties, establishing practices which have since then gone unchallenged. This, too, was the hey-day of the prize courts, in which national judges sat administering international law on the various points of dispute inseparable from world-wide maritime warfare. The great English prize court judge, Lord Stowell (brother of Lord Eldon), gave, during the Napoleonic wars, several thousand decisions on maritime and mercantile matters. His unerring faculty for seizing on the true bearing of each problem presented to him, and his power of applying broad principles of law to every possible circumstance, have resulted in the fact that nine-tenths of his decisions have remained unchallenged since his days, even in other countries.

With the fall of Napoleon began the second period, which may be termed the *co-operative period*. The chief features of this period are the holding of congresses and the development of international law by something analogous to legislation. Thus the Powers met to reconstruct Europe at Vienna in 1815. They did not dissolve before they had jointly come to agreement on international matters calling for decision, such as the slave trade or the machinery of diplomatic intercourse. The Congress of Paris (1856) not only settled the political questions which arose out of the Crimean War, but came to an agreement on questions of law, as, for instance, in connection with the conduct of blockade, which had divided the nations for centuries. The Congress of Berlin (1878), beside its territorial settlement, developed the process, begun at Paris, of agreeing that any interference with the boundaries of the Ottoman Empires was the concern not of any one Power alone, but of all of them. While, finally, in the Hague Peace Conferences (1899 and 1907), as well as in the Conference of London (1909), the tendency running through the period reaches its height, and the student is confronted with international 'legislation' of a sweeping character along a variety of lines.

Then came the European War. The pessimist saw his forebodings realized. The optimist notices that the world may have a different, but still has a body of law, to which it will appeal in international affairs. Moreover, in the League of Nations a genuine attempt has been made to place behind international law an embodiment of international opinion, not only to be called in at a grave crisis, but an ever-living, ever-visible organ of the polity of civilization. "It must function", says General Smuts, "so strongly in the ordinary peaceful intercourse of States that it becomes irresistible in their disputes." In so far as this ideal is realized, a new period in the history of international law will have opened—a period not of *competition* or even merely of *co-operation*, but, perhaps, of *consolidation*. BIBLIOGRAPHY: Viscount Bryce, *Studies in History and Jurisprudence*, vol. ii, essay xi; L. F. L. Oppenheim, *International Law*, 2 vols. (for the nature of international law); Rev. T. J. Lawrence, *A Handbook of Public International Law*; Sir T. E. Holland, *The Congress of the European Powers and the Eastern Question*; W. Alison Phillips, *The Confederation of Europe*; A. P. Higgins, *Hague Peace Conferences*; Sir Geoffrey Butler, *A Handbook to the League of Nations*.

Interplead'er, in law, the right or process by which a man who is called upon by two opposite parties to pay a sum or deliver over goods, and who is not sure which party is the rightful claimant, can call upon the parties to come forward as against each other, and so relieve him.

Inter'polation, in mathematics, a method whereby, when some numbers of a series are given, others may be calculated approximately. For example, the sun's right ascension being tabulated for every Greenwich noon, its value at any other time is found by interpolation. The same object may be attained, but with less accuracy, by means of a graph. If u_a, u_b are the values of a function u for $x = a$, $x = b$; and if u is a *linear* function of x, so that its graph is a straight line, then we have at once from a figure (see *Geometry*)

$$u_x = u_a + \{(x - a)/(b - a)\}(u_b - u_a) \,..\, (1)$$

Even when u is not a linear function of x, its graph between $x = a$ and $x = b$ may not deviate far from the straight line joining the points (a, u_a), (b, u_b); and the formula (1) may still be applied. It is often referred to as the *principle of proportional parts*. The formula may be written $u_x = u_a(x - b)/(a - b) + u_b(x - a)/(b - a)$. This is the simplest case of *Lagrange's interpolation formula*; the next case is $u_x = u_a(x - b)(x - c)/\{(a - b)(a - c)\} +$ two similar terms with a, b, c cyclically interchanged; it may be verified immediately that, when $x = a$, the formula gives $u_x = u_a$; and similarly for $x = b$ and $x = c$. Two important interpolation formulæ are given under *Differences, Finite*.

If the value of x for which u is required does not lie *between* the extreme values for which u is given, the process, usually called *extrapolation* in this case, is not so reliable.

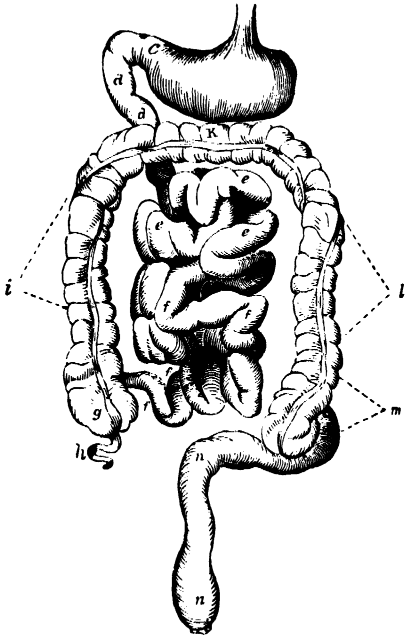
Interregnum (Lat. *inter*, between, and *regnum*, rule) is the name given in Roman history to the interval which elapsed between the death of a king and the election of another. The official holding the power during this interval was called the *interrex*. The great Interregnum in mediæval history is a name given to the period between 1254 and the election of Rudolf of Habsburg in 1273. It is often called the Age of Fist-law (*Faustrecht*). Germany had no ruler at that time who was generally recognized, and confusion reigned everywhere.

Interrog'atories, in English law, written questions put by one party in a civil cause to his opponent, by permission of the judge, in order to obtain evidence before the trial. The interrogatories must not be prolix, irrelevant, or oppressive; and answers may be refused on the ground that the information sought is privileged or may incriminate the party giving it.

Interval, in music, the distance between two given sounds, or their differences in point of gravity or acuteness. Intervals are *simple* when confined within the octave, and *compound* when they exceed it, and are named according to the distance of the two boundary notes. Thus the interval of a whole tone (CD) is called a second, of a whole tone and a semitone (CE♭) a minor third, &c. All the intervals of any major scale reckoning up from the key-note are *major*. Intervals a semitone less are *minor*. If they are a semitone greater than major, they are *augmented*; if a semitone less than minor, they are *diminished*. See *Music*.

Intes′tacy, in law, the condition of a person who dies without having left any will at all, or having left one not legally valid, or such a will that nobody becomes heir under it. The general principle in Britain and the United States is that the law provides an heir or next of kin if the owner himself has not done so. In the case of a person dying wholly or partially intestate, the property not included in the settlement goes, under English law, to the heir-at-law or next of kin according as it is real or personal estate, but subject in the former case to the widow's dower, and in the latter to the widow's right to one-third if the intestate has left issue, and to £500 and one-half of the balance if he has not. If the intestate was a married woman, her husband succeeds to all her personal estate and, if an heir has been born, to a life interest in her real estate.

Intes′tine (Lat. *intestinum*, from *intus*, within), the name given to the part of the alimentary canal that extends from the right or pyloric orifice of the stomach to the anus, and which receives the ingested food from the stomach, retains it for a longer or shorter period, mixes it with the bile, pancreatic juice, and intestinal secretions, gives origin to the absorbent vessels which take up the nutriment and convey it into the current of the blood, and which, lastly, conveys the fæcal or indigestible products from the system. In man it is usually divided into the *small intestine*, which comprehends the duodenum, jejunum, and ileum; and the *large intestine*, comprehending the cæcum, colon, and rectum. Three distinct coats are to be distinguished in the structure of the small intestine; these, named from without inwards, are known as the *serous*, *muscular*, and *mucous* coats. The innermost or mucous coat presents several interesting structures. Among these are the *valvulæ conniventes*, or closely-folded transverse plaits of the mucous membrane, the functions of which would appear to be those of serving materially to increase the digestive surface or area of the intestine, and thoroughly mingle the ingesta with the secretions. The surface of the membrane is covered with innumerable fine projections termed *villi*, which give to it almost a velvety texture. Each villus is found under the microscope to be an outstanding process of the mucous membrane, containing internally an artery giving off minute ramifications, a vein by which the venous blood is returned, and, lastly, the lacteal or absorbent vessel. The function of the villi, which are most numerous in the duodenum, is pre-eminently that of the absorption of the chyle or fluid product of digestion, as a preliminary to its transmission to the current of the blood or circulation. Four varieties of glands are also connected with the small intestine, the first three being named after their respective discoverers, Lieberkühn, Peyer, and Brunner, and the other variety occurring singly—the 'solitary' glands—and in groups—Peyer's patches. The exact functions of these bodies are not well known. The duodenum lies in the epigastric region, and



The Alimentary Canal

c, The pylorus, the small end of the stomach where it opens into the first part of the small intestine. *d*, *d*, The duodenum or commencement of the small intestine. *e*, *e*, *e*, The jejunum or second part of the small intestine. *f*, *f*, *f*, *f*, The ilium or third and terminal portion of the small intestine. *g*, The cæcum. *h*, The vermiform appendix. *i*, The ascending colon or first portion of the large intestine. K, The transverse colon. *l*, The descending colon. *m*, The sigmoid flexure of the colon. *n* The rectum.

makes three turnings, receiving by a common opening between its first and second flexure the bile-duct and the pancreatic-duct. The conversion of the chyme from the stomach into chyle is thus accomplished in the duodenum. The jejunum, commencing at the left side of the second lumbar vertebra, becomes insensibly and gradually continuous with the ileum, which, terminating the small intestine, becomes continuous with the large intestine in the right iliac fossa, and opens into the *colon*, or first portion of the large intestine, which is divided from the large intestines by the ileo-cæcal valve. Below the point at which the ileum opens into the colon we find a short blind sac continuous with the colon, and known as the *cæcum*; and attached to the lower extremity of the cæcum, and communicating with the cæcal cavity, we find a little closed tube, to which the name of *appendix vermiformis* or simply *appendix* is applied. We next find the colon ascending in the right lumbar region, in front of the kidney. This portion is known as the *ascending colon*. It then crosses the abdominal cavity to the left side, and becomes the *transverse colon*; and finally descends as the *descending colon*, in front of the left kidney into the left groin, where, after making a curve like the letter S—*sigmoid flexure* of the colon—it terminates in the last portion of the intestinal tract. This last portion, known as the *rectum*, finally terminates in the anus. The large intestine measures from 5 to 6 feet in length; the small intestine measures from 16 to about 24 or 26 feet in length; so that the entire intestinal tract may be regarded as being about five or six times the length of the body itself. The three coats of the small intestine are repeated in the large intestine. The mucous or inner coat is not elevated to form villi in the large, as in the small intestine, and only two kinds of glands, the glands of Lieberkühn, and the solitary glands, are to be distinguished in the large intestine. The function of the large intestine is chiefly excretory, but a certain power of absorption is also exercised by its vessels. The food is propelled along the entire intestinal tract by the alternate contraction of the longitudinal and circular muscular fibres, by which means it is gradually pushed along the tube with a *vermicular* or *peristaltic* movement. The ileo-cæcal valve serves to prevent regurgitation of matters into the small intestine, after they have passed into the colon. The *mesentery* is the term given to the fold of peritoneum by means of which the small intestines are attached to the spine. The blood-vessels supplying the intestinal tube are the *superior* and *inferior mesenteric arteries* and their branches, derived from the *abdominal aorta*. The veins of the intestines empty their contents into the *vena portæ*, which distributes itself through the liver, and from the blood of which the bile is secreted by the hepatic or liver cells. The nerves of the intestines are derived from the *sympathetic* or *autonomic system* of nerves, and have also a connection with the tenth cranial nerve—the vagus nerves.

Intui'tion (Lat. *intueor*, to behold, gaze upon), in its narrowest sense, means, according to its etymology, an image in the mind acquired directly by the sense of sight, i.e. immediate knowledge, in contrast with mediate, direct perceiving or beholding. The German term is *Anschauung*, and is used to signify any notion directly presented by an object of sense. Kant distinguishes *empiric intuitions* (those conveyed by the senses from external objects) and *pure intuitions*, or intuitions a priori, which are the basis of the former, for instance, space and time; as nothing can be perceived by our senses except either in space or time, our notions of these must precede the empiric intuitions. The term intuition is sometimes used in English philosophy to denote an a priori knowledge of first principles, a kind of spiritual instinct or inspiration which enables us at once to know the distinction between right and wrong, a knowledge ' derived by intuition '.

Intussuscep'tion (Lat. *intus*, within, and *suspicere*, to take up), in pathology, the descent of a higher portion of intestine into a lower one: generally of the ileum into the colon. When it takes place downwards, it is termed *progressive*; when upwards, *retrograde*.

In'ulin, a carbohydrate substance allied to starch, and taking the place of that compound as a reserve material in many Compositæ (e.g. Jerusalem artichoke) and in some other plants. It is present in a state of solution, but is readily precipitated by alcohol.

Invalides (aṇ-vȧ-lēd), **Hôtel des**, a splendid hospital for disabled soldiers at Paris, erected by Louis XIV between 1670 and 1673. A soldier must have served ten years to be received into this hospital on account of poverty or infirmity. In the vaults there lie the remains of Turenne, Vauban, and several other great French commanders, including those of Napoleon I, brought from St. Helena on 15th Dec., 1840, and placed in a porphyry sarcophagus in 1861.

Invar, an alloy of steel and nickel, the invention of C. E. Guillaume, which has a very small coefficient of expansion. It is used in the construction of the finer measuring appliances employed in geodesy, for clock pendulums, and other purposes where expansions must be small or easily compensated. In the silica lamp, which is of the mercury-vapour type with a quartz tube, the leading-in wires are made of invar in the same way as platinum is used for electric lamps with glass bulbs.

Invariant, in mathematics, a function which remains unchanged under specified transformations. The meaning of the term will be best seen from one or two simple examples. Let the quadratic function, or *form*, $ax^2 + 2hxy + by^2$ be transformed by the substitution $x = \mathrm{X} \cos\alpha - \mathrm{Y} \sin\alpha$, $y = \mathrm{X} \sin\alpha + \mathrm{Y} \cos\alpha$; where X, Y are the new variables. The function becomes $a(\mathrm{X} \cos\alpha - \mathrm{Y} \sin\alpha)^2 + 2h(\mathrm{X} \cos\alpha - \mathrm{Y} \sin\alpha)(\mathrm{X} \sin\alpha + \mathrm{Y} \cos\alpha) + b(\mathrm{X} \sin\alpha + \mathrm{Y} \cos\alpha)^2$. If we write this expression in the form $\mathrm{AX}^2 + 2\mathrm{HXY} + \mathrm{BY}^2$, we have $\mathrm{A} = a \cos^2\alpha + 2h \cos\alpha \sin\alpha + b \sin^2\alpha$; $\mathrm{B} = a \sin^2\alpha - 2h \cos\alpha \sin\alpha + b \cos^2\alpha$, $\mathrm{H} = (b - a) \cos\alpha \sin\alpha + h(\cos^2\alpha - \sin^2\alpha)$. We see at once that $\mathrm{A} + \mathrm{B} = a + b$. Now $\mathrm{A} + \mathrm{B}$ is the *same function* of the new coefficients as $a + b$ is of the old; $a + b$ is therefore called an *invariant* of the quadratic form. The geometrical interpretation is very instructive. The transformation turns the rectangular axes through an angle α. The lines $ax^2 + 2hxy + by^2$ are at right angles if $a + b = 0$, and $\mathrm{A}x^2 + 2\mathrm{H}xy + \mathrm{B}y^2 = 0$ are at right angles if $\mathrm{A} + \mathrm{B} = 0$. The equations $a + b = 0$ and $\mathrm{A} + \mathrm{B} = 0$ express the same geometrical fact, and it is therefore not surprising that $a + b$ should be equal to $\mathrm{A} + \mathrm{B}$. Another invariant of the quadratic is $ab - h^2$. Its vanishing is the condition that the lines should be coincident. More generally, in plane geometry, any curve is represented by a homogeneous equation in three variables, say $u = 0$; and an invariant of u is a function of the coefficients which, when equated to zero, expresses some intrinsic or inherent property of the curve, independent of co-ordinate axes. *Covariants* are functions, with properties similar to those of invariants, but involving the variables x, y, &c. The theory of invariants and covariants is very extensive. Many analysts have helped to develop it, but its foundations were laid soundly and broadly by the great English mathematician Cayley.—BIBLIOGRAPHY: J. H. Grace and A. Young, *Algebra of Invariants*; G. Salmon, *Higher Algebra*, *Conic Sections*; W. S. Burnside and A. W. Panton, *Theory of Equations*.

Inveraray (in-vėr-ā′ri), a Scottish royal burgh, capital of the county of Argyle, formerly capital of West Highlands, beautifully situated near the head of Loch Fyne, 42 miles north-west of Glasgow, having the castle of the Duke of Argyll in the immediate vicinity. It unites with Ayr, Campbeltown, &c., in sending a member to Parliament. Pop. 490.

Invercargill (-gil′), a town of New Zealand, county of Southland, province of Otago, situated near the mouth of the New River, about 150 miles s.w. of Dunedin. It is well built, and has an athenæum, hospital, public halls, street tramways, breweries, foundries, flour-mills, &c. The surrounding district is pastoral and agricultural. It is connected by rail with the port of Campbelltown, 17 miles distant and situated near the entrance to Bluff Harbour. Here there is excellent accommodation for the largest vessels at all states of the tide. Pop. (with suburbs), 18,000.

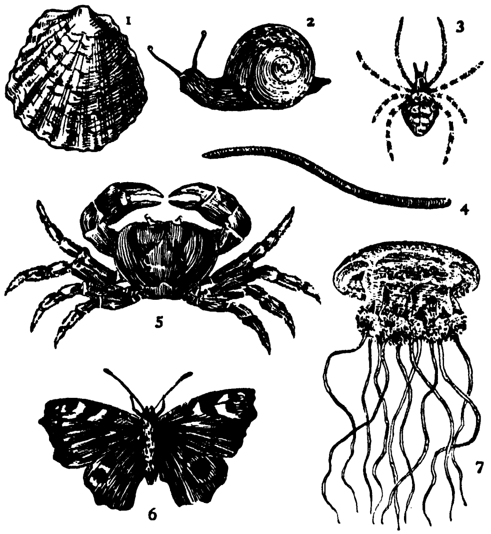
Inverkeithing (-kē′thing), a royal and police burgh (Stirling district) and seaport of Scotland, in Fifeshire. The battle of Inverkeithing between Cromwell's troops and the adherents of Charles II was fought on 20th July, 1650. It is now a central town for the Forth Bridge and for Rosyth Naval Base. Pop. (1921), 5464.

Inverness′, a royal and municipal burgh in Scotland, capital of the county of the same name, and chief town of the Highlands. It is beautifully situated, partly on low ground and partly on a gentle acclivity, on either side of the Ness, about a mile above its confluence with the Moray Firth, near the end of the Caledonian Canal. The town is well built, among the chief edifices being the county buildings, a fine castellated structure, containing the court-house and jail; the town hall (a new building), the episcopal cathedral, the Highland Club, and the Royal Academy, besides several handsome banks and hotels. The industries include shipbuilding, rope-making, tanning, distilling, and brewing, and there is a considerable trade. There is regular communication by sea and canal with Glasgow, Liverpool, Aberdeen, and Leith. Large vessels can unload at the quays. Inverness received a burgh charter from William the Lion in the twelfth century. Pop. (1921), 20,937.

Inverness, or **Inverness-shire**, the largest county of Scotland, stretches diagonally across it from sea to sea, and includes on the west the Island of Skye, several smaller islands, and all the outer Hebrides, except the north of Lewis. Area, 2,695,094 acres, of which only about 100,000 are under tillage. Great part of the surface is barren heath, useless except for sporting purposes, but a considerable portion is suited for rearing cattle and sheep. It is divided by Glenmore or the Great Glen of Albyn, which intersects it north-east to south-west, and through which passes the Caledonian Canal, formed by uniting a series of considerable lakes which stretch along the bottom of the valley. The south-west shores of the county are indented with numerous lochs or arms of the sea. The surface generally is mountainous, and presents much fine scenery. Near the south-western extremity of the Caledonian Canal is Ben Nevis, 4406 feet high, the loftiest mountain in Great Britain. The geological structure of the greater part of the county is of crystalline and metamorphic rocks, consisting chiefly of gneiss and mica-slate, with granite, porphyry, and trap rocks. The portion of the county bordering the Moray Firth is composed of Old Red Sandstone. The principal rivers are the Spey, Ness, and Beauly, on all of which there are valuable salmon-fisheries. Some of the lakes are of considerable size, and beautifully situated. The largest is Loch Ness, forming part of the Caledonian Canal route. Extensive tracts are held as deer forests, in which the red and roe deer roam at will. The arable and productive land lies chiefly on the sea-coast, and on the banks of the lakes and rivers. Gaelic is the prevailing language, about 5000 persons speaking no other, and upwards of 36,000 being bi-lingual. Since 1918 Inverness-shire unites with Ross and Cromarty in returning three members to Parliament. Pop. (1921), 82,446.

Inversion, a method of transformation of geometrical figures, which has useful applications in mathematical physics, as well as in pure geometry. Let O be a fixed point, P any point; and let P' be taken in the line OP so that $OP \cdot OP' = k^2$, where k is constant. Then P' is said to be the *inverse* of P with respect to the *centre of inversion* O; and k is called the radius of inversion. The *inverse of a curve* is the locus of the inverses of points on the curve. The inverse of a circle is a circle, unless the centre of inversion is on the original circle, in which case the inverse is a straight line. By proper choice of centre and radius of inversion, an inverse of a figure may often be found simpler than the figure itself, e.g. any two non-intersecting circles can be inverted into concentric circles. The point of the method is that a theorem or problem can be dealt with in the simplified figure, and then transferred to the original figure by a reinversion. It was by the method of inversion that Lord Kelvin, early in his career, found his wonderful solution of the problem of the distribution of electricity on a spherical bowl.—Bibliography: J. Casey, *Supplement to Euclid*; J. Clerk Maxwell, *Electricity and Magnetism* (vol. i).

Invertebra'ta, in zoology, a collective term for all animals not belonging to the phylum Vertebrata (Chordata), and therefore lacking the following distinctive characters. (1) Central nervous system tubular and dorsal. (2) An elastic supporting-rod, the *notochord*, underlies the nerve-tube in the embryo, but is usually more or less replaced by a vertebral column (backbone) in the adult. (3) Gill-pouches always present in the embryo, and persisting throughout life in fishes and some amphibia. (4) Heart ventral. (5) Not more than two pairs of limbs. (6) Jaws part of the wall of the head, and lower jaw, when present, moving up and down. (7) Reproduction sexual only. Among higher invertebrates the heart is ventral; the limbs are often numerous; the jaws are modified limbs and move from side to side; and asexual reproduction by *budding* or *gemmation* and by *fission* is common. Hard parts, when present, are in the form of an *exo-skeleton*, i.e. an external shell or test. The most important phyla of invertebrates are: (1) Arthropoda, jointed-limbed animals, such as lobsters, insects, spiders, and centipedes. (2) Annelida, segmented worms, e.g. lug-worms, sea-centipedes, sea-mice, and earthworms. (3) Mollusca, shell-fish, as cuttle-fishes, snails, and bivalves. (4) Brachiopoda, lamp-shells. (5) Polyzoa, mostly colonial, as sea-mats and moss-polypes. (6) Nemathelmia, thread-worms and round worms. (7) Platyhelmia, flat worms, e.g. tape-worms and flukes. (8) Gephyrea, spoon-worms. (9) Nemertinea, proboscis worms. (10) Rotifera, wheel animalcules. (11) Echinodermata, hedgehog-skinned animals, e.g. starfish, sea-cucumbers, and sea-urchins. (12) Cœlenterata, zoophytes, e.g. sea-anemones, corals, and jelly-fish. (13) Porifera, sponges. (14) Protozoa, animalcules.



Invertebrata

1, Oyster. 2, Snail. 3, Spider. 4, Worm. 5, Crab. 6, Butterfly. 7, Jelly-fish.

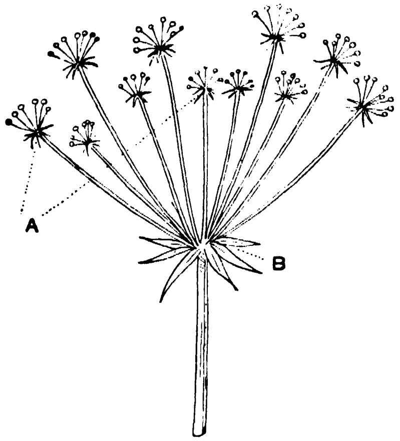
Inverurie, a royal and municipal burgh of Scotland, in Aberdeenshire, where the Ury joins the Don, included in the Elgin group of parliamentary burghs. It has railway-works and paper-works. Pop. (1921), 4330.

Inves'titure, in the feudal law, was the open delivery of a fee or fief by a lord to his vassal, thus, by external proof, affording evidence of possession; or the formal introduction of a person into some office or dignity. Investiture was usually performed by the presentation of some symbol to the person invested, as a branch of a tree, &c. The investiture of persons with ecclesiastical offices or dignities is historically the most important phase of the subject. The estates and honours which composed the ecclesiastical temporalities were considered to partake of the nature of fiefs, and therefore to require similar investiture from the lord, but the symbols used for the investiture of bishops, the episcopal ring and the crosier or pastoral staff, were ecclesiastical in character, and, in the course of the revival of the power of the Papacy in the second half of the eleventh century, the Church forbade the practice as an infringement of the rights of the See of Rome. The consequent dispute with the lay power came to a head after Pope Gregory VII (Hildebrand) issued, in 1075, a decree against lay investiture of bishops, which he declared to be allied to simony. In Germany the emperor, Henry IV, resisted the Pope, who allied himself with Henry's German enemies, and a long war ensued, in the course of which the emperor, in 1077, submitted to the Pope at Canossa. This did not end the quarrel, which was continued under the next emperor, Henry V, who in 1111 forced Pope Paschal II to abandon the claims of the Papacy, but the renunciation was withdrawn, and the struggle continued until 1122, when Henry V agreed on a compromise with Pope Calixtus II. By a concordat arranged at Worms, Henry V resigned for ever all pretence to invest bishops by the ring and crosier, and recognized the freedom of elections: the new bishop, however, was to receive his temporalities by the sceptre. In England Paschal II had been engaged in a similar contest. Anselm, the Primate, refused to do homage to Henry I for the temporalities or feudal possessions of his see. The king asserted an unqualified right of investiture, which the Pope as unqualifiedly denied. After a protracted struggle the controversy ended in England, as it did afterwards in Germany, by compromise. Paschal offered to concede the objections against homage provided Henry would forego the ceremony of investiture. To this he agreed (1107).—Cf. A. C. Welch, *Anselm and his Work.*

Invincibles, a name applied to a certain section of the Fenians, or to persons of similar aims and reckless as to using extreme measures. It was by a band of these 'invincibles' that Lord Frederick Cavendish and T. H. Burke were murdered in Dublin in 1882.

In′voice (Fr. *envoyer*, to send), an account in writing of the particulars of merchandise transmitted to a purchaser, giving price and quantity, note of charges, and any other needful details. By sending an invoice along with goods a merchant gives official advice to his correspondent of the understood terms of a contract. If the goods are received and the invoice retained, this will be held valid evidence in law of the contract.

Involu′cre, in botany, a collection of bracts round a circle of flowers. In umbelliferous plants it consists of separate narrow bracts placed in a single whorl; in many composite plants these organs are imbricated in several rows.



Involucre. Diagram of an Umbelliferous Plant

A, Secondary bracts. B, Primary bracts.

Io, in Greek mythology, the daughter of Inachus, the river god of Argos and its first king. She was beloved by Zeus, who, to protect her from the jealousy of Hera (Juno), changed her into a beautiful white heifer.

Iodic Acid, HIO_3, is obtained by heating iodine with concentrated nitric acid. It forms a colourless crystalline solid which is soluble in water, and a series of salts, the iodates, of which sodium iodate, occurring in Chile saltpetre, is the most important. On heating, iodic acid loses water, being converted into iodine pentoxide, which at higher temperatures breaks up into iodine and oxygen.

I′odine (Gr. *ion*, violet), symbol, I; atomic weight, 127, is a non-metallic element belonging to the halogen group. It occurs in the form of metallic iodides in sea-water, from which it is extracted by certain sea-weeds, notably *Laminaria digitata* and *Laminaria stenophylla*, which may contain as much as 0·5 per cent of the element. It is also present in the form of sodium iodate in crude Chile saltpetre or caliche to the extent of about 0·2 per cent. The thyroid gland contains a small quantity of iodine. In extracting iodine from sea-weed the dried weed is burnt, the ash or *kelp* boiled with water, and the solution concentrated until most of the common salt present has separated. The residual liquor containing the iodides in solution is then heated with sulphuric acid and manganese dioxide, the iodine which distills over being condensed in a series of cooled earthenware receivers.

From caliche, iodine is obtained from the mother-liquors remaining after the sodium nitrate has been separated by recrystallization. They are treated with sodium bisulphite, which precipitates the iodine in the solid state. The crude substance is purified by sublimation.

At the ordinary temperature iodine is a crystalline solid of greyish-black colour, having a high metallic lustre and a specific gravity of 4·95. It melts under pressure at 114° C. On heating in the air it sublimes, giving rise to a dense, pungent-smelling violet-coloured vapour, hence its name. It is very slightly soluble in water, more freely in alcohol and ether, and especially so in potassium iodide solution, forming brown solutions in each case; in carbon disulphide and chloroform the solution is violet. In its chemical properties it resembles chlorine and bromine, but is less active. In combination it forms series of salts, the iodides and iodates being the most important. With starch, a deep blue coloration is produced, which serves as a characteristic test for iodine; a solution of one part in a million can be detected by this means. Taken internally iodine acts as an irritant poison, but in small doses it is of service in the treatment of certain forms of glandular disease. Externally it is applied in alcoholic solution (tincture of iodine) as an antiseptic and as a counter-irritant and anti-parasitic. In the form of potassium iodide it has been found of great benefit in the treatment of goitre, scrofula, diseases of the liver and spleen, and in syphilitic affections, rheumatism, &c., as well as in lead-poisoning.

Iodine is also largely used in the preparation of certain aniline colours and in other branches of technical chemistry.

Of its compounds, iodoform and iodol are used as antiseptics, and silver iodide enters into the composition of photographic films and plates.

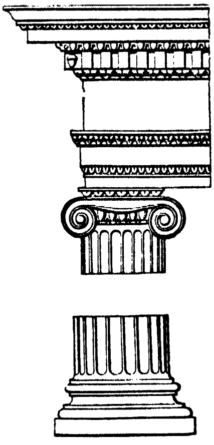
Iod′oform, CHI_3, a substance analogous to chloroform, with iodine replacing chlorine. It crystallizes in small, yellow, hexagonal plates of melting-point 119° C., and is prepared by the action of alcohol or acetone on iodine and potash, or electrolytically; the latter method is used exclusively for its manufacture. Iodoform is almost insoluble in water, but dissolves in ether, oils, and alcohol. It is used in medicine as an antiseptic, either dry or as an ointment. The strong odour of the substance renders its use as an antiseptic objectionable, and other iodine preparations have been introduced. Iodol (C_4I_4NH), for instance, is odourless, and is claimed to have the same antiseptic action as iodoform.

I′on, an ancient Greek tragic poet, a native of Chios, who flourished in the age of Pericles. He wrote several tragedies, winning the third prize in 429 B.C. He also wrote comedies and dithyrambic and lyric poems, besides composing a history of the antiquities of Chios and an account of the visitors to that island. Only a few fragments of his work remain.

Io′na, an island of Scotland, one of the Inner Hebrides, belonging to the county of Argyle, separated from the south-west extremity of Mull by the Sound of Iona, 1¼ miles wide, and about 7½ miles south-west of Staffa. The name is believed to be a misreading of *Iova, Ioua*, a name that occurs in old MSS., but the most common ancient name was I, Y, Hy (or similar forms). It was also commonly called I-colm-kil or I-columb-kill, that is, 'isle of Columba's cell' or 'isle of Columba of the cell (or church)'. It is about 3 miles long by 1½ miles broad; area, about 2000 acres, of which 600 acres are under cultivation, the remainder being hill pasture, morass, and rock. It derives its interest from its history and old ruins, the remains of religious establishments of uncertain date, but popularly attributed to Columba, who took up his residence here in A.D. 563. They are all, however, of a much more recent date. The principal ruins are those of the cathedral church of St. Mary, of a nunnery, five chapels, and of a building called the Bishop's House. St. Oran's Chapel, as it is called, is supposed to be the most ancient; it is small, being only 60 feet by 20 feet. Attached to it is a burying-ground, in which various kings of Scotland, Ireland, and Norway are said to have found their last resting-place. The cathedral, which was restored and reopened in 1905, is cruciform, surmounted at the intersection of the nave and the transept by a square tower of about 70 feet in height. The length of the transept is 70 feet, and that of the body of the church, east to west, 160 feet. The island is now easily reached in summer by steamers daily from Oban. Pop. *c.* 200.—Cf. F. M. Macneill, *Iona: a History of the Island with Descriptive Notes.*

Ionia, that part of the seaboard of Asia Minor which was inhabited by Ionian Greeks, a beautiful and fertile country opposite the Islands of Samos and Chios, which also belonged to it. According to tradition, the Greek colonists came over from Attica about the middle of the eleventh century B.C., and founded twelve towns, which, though mutually independent, formed a confederacy for common purposes. These included Phocæa, Ephesus, Miletus, &c., and afterwards Smyrna. Commerce, navigation, and agriculture early rendered them wealthy and flourishing, but the country was made tributary by Crœsus, King of Lydia, and later by Cyrus, King of Persia (557 B.C.). With an interval of independence they remained under Persia until this empire was overthrown by Alexander the Great, 334–331 B.C., when they became a part of the Macedonian Empire. Ionia, at a later period, became part of the Roman province of Asia. It was afterwards totally devastated by the Saracens, so that few vestiges of its ancient civilization remain.

Ionian Islands, a number of Greek islands in the Ionian Sea, extending along the western and southern shores of Greece, of which the largest are Corfu, Cephalonia, Zante, and Cerigo, others being Ithaca or Thiaki, Paxos, and Santa Maura; area, 1100 sq. miles. All are extremely mountainous; and were it not for the vine, olive, and currant, especially the last, they could support but a small number of inhabitants. The climate is more uniformly temperate and humid than the mainland. The staple exports are oil, currants, valonia, wine, soap, and salt. The few manufactures are chiefly textile and ornamental. The religion is that of the Greek Church. The Ionian Islands often figure in the ancient history of Greece, but only singly. In 1386 Corfu voluntarily surrendered itself to Venice, and soon after the other islands placed themselves under its protection. In 1797 the French became masters. In 1809–10 they were occupied by British troops, and in 1815 the seven islands were formed into a republic, under the protectorate of Great Britain. They were transferred to Greece in 1864. Pop. about 270,000.


Ionic Order—Grecian

Ionic Order, one of the orders of classic architecture, the distinguishing characteristic of which is the volutes of its capital. In the *Grecian Ionic* (1) the stylobate consists of three receding equal steps the combined height of which is from four-fifths to a whole diameter; (2) the column, which includes band, shaft, and capital, is rather more than nine diameters in height, the shaft being fluted with twenty-four flutes and alternating fillets; while (3) the entablature is rather more than two diameters in height. The volutes are connected on the flanks by a peculiar roll-moulding, called the *baluster* or *bolster*. In the *Roman Ionic*, a modification of the latter style, the stylobate is lofty and not graduated; the shaft diminishes one-tenth of a diameter and has twenty fillets and flutes; the capital, which is two-fifths of a diameter, has its volutes a little lower than the other, and a square abacus with moulded edges covers the whole. The chief examples of the Grecian Ionic are those of the Athenian Acropolis; while those of the Roman Ionic are found in the temple of Fortuna Virilis and the Coliseum at Rome.

Ionic School, the earliest school of Greek philosophy, a school which attempted to explain the phenomena of nature from the forces and attributes of matter itself. It taught the doctrine of the immediate unity of matter and life, according to which matter is by nature endowed with life, and life is inseparably connected with matter. The matter, with which the Ionian philosophers are concerned, is not conceived by them as anything apart from spirit. They do not inquire into the questions concerning the distinction between mechanism and spirit. They are, however, clearly averse to anthropomorphic and mythological ideas and physical causation; matter and motion are for them manifestations of the absolute reality. The originator of this school, and indirectly of Greek philosophy in general, was Thales, who flourished about 600 B.C. The other chief philosophers of the school were Anaximander, Anaximenes, Xenophanes, Heraclitus, and Anaxagoras. See the separate articles.—Cf. T. Gomperz, *Greek Thinkers*.

Ionization. This term was first used by Faraday to describe the process which certain substances known as electrolytes undergo when dissolved in water, and which causes the resulting solution to be a conductor of electricity. To explain the laws of electrolysis (q.v.) he assumed that the substance in solution was disintegrated into its constituent elements or radicles, each of which carried an electric charge. These charged atoms or radicles he called *ions*, and the process resulting in the formation of these ions he called *ionization*. The process is quite distinct from chemical decomposition, and the ions do not exhibit the chemical properties of the corresponding uncharged atoms or radicles.

The process may be regarded as follows. Taking common salt (sodium chloride) as an example, we suppose that the compound itself is formed by the passage of a negative electron (see *Electron*) from the sodium atom, which is known to give up an electron very readily, to the chlorine atom, which has a strong tendency to absorb an electron. These tendencies are readily explained on the electron theory of the atom. The chlorine atom in the molecule of salt is thus negatively charged; the sodium atom is positively charged. The attraction between these opposite charges is the 'chemical bond' which binds the molecule together. Chemical combination of this type has been called *molecular ionization* by Sir J. J. Thomson. On dissolving the salt in water the bond is in some way broken, and the atoms of sodium and chlorine separate, each retaining its own charge. The exact cause of the ionization is not yet beyond dispute, but it may be pointed out that, owing to the high specific inductive capacity of water, the electrical force between the charged atoms in aqueous solution will only be about one-eightieth of the force in air, and thus the bond holding the molecule together is greatly weakened by solution. The attraction between the charged sodium ion and an uncharged molecule of the solvent may then be greater than that between the sodium atom and its associated chlorine atom, and the molecule will thus be broken up or ionized.

On applying an electric field to the solution, the charged ions, being acted upon by the field, will drift through the solution, the positive ions towards the negative electrode, the negative ions towards the positive electrode, with velocities which depend on the nature of the ion and the temperature and concentration of the solution. Under given conditions the velocity is directly proportional to the strength of the applied field, and the velocity acquired under a field of 1 volt per centimetre is called the mobility of the ion. These mobilities are all small. Thus the hydrogen ion, which is the most mobile of them, has a velocity of only ·00325 cm. per second in a field of 1 volt per centimetre. The very large currents which can be transmitted by electrolytic solutions are due not to the speed of the carriers, but to their enormous number.

The term ionization is also applied to the process by which a gas is rendered conducting. Gases, under normal conditions, are almost perfect insulators. They can, however, be made temporarily conducting to a slight extent by subjecting them to the action of various agents, known as *ionizing agents*, of which the most important are X-rays, ultra-violet light, and the radiations from radio-active substances. If an insulated conductor is given an electric charge and an X-ray tube is excited in its neighbourhood, the conductor rapidly loses its charge, and a similar effect is observed if a sample of any radio-active substance is brought near it. This is due to the formation in the gas of positively and negatively charged molecules, which by analogy with the phenomena of electrolysis are called *gaseous ions*. If there is an electric field in the gas, these gaseous ions will move in the field in a manner analogous to the motion of the ions in an electrolyte. Thus a positively charged conductor will attract the negative ions, or a negatively charged conductor will attract the positive ions, until its charge is completely neutralized by the charges conveyed to it by the ions. Similarly, if two electrodes, immersed in the gas, are maintained at a difference of potential, by being connected to the poles of a battery of cells, a current will be conveyed across the gas between the electrodes by the motion of the charged gaseous ions in the same way that a current is conveyed through an electrolytic cell by the motion of the electrolytic ions. Such an arrangement forms what is known as an *ionization chamber*. A convenient form of ionization chamber consists of a pair of metal plates placed parallel to each other in the gas, and a few centimetres apart.

The process of ionizing a gas commences with the ejection of a negative electron from the molecule of the gas. When the ionizing agent is an α- or β-ray from a radio-active substance, the expulsion is due to collision between the particles which constitute the rays (see *Rays, Electric*) and one of the electrons present in the atoms of the gas. In the case of X-rays, the strong electric field in the ray causes the ejection of a negative electron with such a high velocity that it acts like a β-ray, and produces a fresh emission of electrons from the atoms through which it passes. The ionization by X-rays is thus mainly a secondary effect of the rays. In either case, however, the molecule from which the electron has been expelled is left with a positive charge, while the expelled electron is attracted to an uncharged molecule, to which it clings, thus giving the molecule a negative charge. The gas through which the rays are passing thus contains positively and negatively charged molecules or *ions*.

The existence of these ions can be demonstrated by sending a flash of ionizing radiation through air which is saturated with water-vapour, and then suddenly chilling the air, most conveniently by allowing it to expand rapidly. The charged ions serve as nuclei for the deposition of the excess water-vapour, and each ion is seen surrounded by a glittering drop of water. If the ionization is not too intense, the number of ions in the gas can actually be counted. C. T. R. Wilson has in this way obtained very beautiful photographs of the actual tracks of the ionizing radiations through a gas.

Since a gaseous ion is formed by the emission of an electron from a neutral atom, the charge on a gaseous ion is equal to the electronic charge, and also to the charge on a monovalent electrolytic ion. Owing to the much smaller resistance to motion offered by a gas than by a liquid, the mobility of the gaseous ions is much greater than that of electrolytic ions, the mobility of an ion in air under normal conditions being about 1·36 cm. per second in a field of 1 volt per centimetre for the positive ion, and rather more for the negative ion. The higher speed of the negative ion is due to the fact that over part of its path it is in the free electronic condition.

In many ways, however, gaseous ionization differs from electrolytic ionization. In the first place the number of gaseous ions is relatively very small. It has been calculated that with a moderately strong beam of X-rays passing through the gas an individual molecule would not become ionized on an average more than once every hundred years. Thus the ionization currents produced are usually far too weak to affect even a sensitive galvanometer. They are measured by finding the rate at which the charge increases on an electrometer or electroscope connected to one electrode of the ionization chamber. In this way currents as small as 10^{-16} ampere can be measured. This corresponds to the transference to the electrode of about 700 ions per second. As both positive and negative ions are molecules of the same gas, there is no chemical difference between them, and the ionization current in a gas does not produce chemical decomposition.

The most important distinction between the two kinds of ionization lies in the fact that gaseous ionization is not spontaneous, the ions being formed by an external agency. As the gaseous ions are oppositely charged, they attract each other, and on colliding exchange charges, parting again as neutral molecules. This process is called *recombination*. If the ionizing agent is withdrawn, this recombination rapidly results in the removal of all ionization from the gas, which, after the lapse of a few seconds, again becomes non-conducting. If the field applied between the electrodes of the ionization chamber is small, so that the ions take an appreciable time to reach the electrodes, many will recombine before reaching an electrode, and the current will be small. By sufficiently increasing the applied field and consequently the velocity of the ions, a stage may be reached when all the ions reach the electrodes without recombination, and the current then becomes independent of the applied electromotive force. This current is known as the *saturation current*. Saturation is generally reached with a field of 20 volts per centimetre. The saturation current is obviously proportional to the rate of formation of the ions in the gas, and this, in turn, is proportional to the intensity of the ionizing agent. A measurement of the saturation current produced by a given ionizing radiation is the most sensitive and accurate method of measuring the intensity of the radiation itself. Small quantities of radium are measured, in practice, by comparing the saturation currents produced in an ionization chamber by the γ-rays they emit with that produced by the γ-radiation from a standard quantity of radium at the same distance.

A certain amount of energy must be expended to expel an electron from a neutral molecule, and thus work must be done by the ionizing agent in ionizing the gas. The energy necessary to produce an ion varies somewhat with the nature of the gas, but is of the order of $1{\cdot}7 \times 10^{-11}$ ergs in the case of hydrogen. It is generally expressed in terms of the difference of potential through which an electron must fall to attain the necessary energy. This is known as the *ionization potential* of the gas, and amounts to 11 volts for hydrogen. It is clear that if we sufficiently increase the potential difference between the electrodes of an ionization chamber, we shall eventually reach a stage when the ions formed in the gas acquire velocities sufficiently high to enable them to form fresh ions on colliding with an uncharged molecule. This process is termed *ionization by collision*. Ionization by collision occurs most readily when the pressure of the gas is low, as the mobility of the ions is greater at low pressures. As the ions formed by collision are able to repeat the process on still other uncharged molecules, the number of ions in the gas increases enormously when this stage is reached, and eventually a spark or an electric arc is formed between the electrodes. Under these circumstances the current through the gas may reach several amperes.

Ultra-violet light, if of sufficiently high frequency, will ionize a gas directly. If the frequency is too small for this, the light may still cause the emission of negative electrons from the metal electrode if it is allowed to impinge upon it (see *Photo-electric Effect*), the electrons forming ions by combining with neutral molecules of the gas. In this case the ions in the gas are all of the same sign, and a current will pass through the gas only when the illuminated electrode is negatively charged. Gases may also be ionized in the presence of various chemical actions (e.g. during the slow oxidation of phosphorus) and by bubbling through solutions of various substances. The gases of flames are also intensely ionized, the ionization being increased if salt vapours are present in the flame, or if the electrodes are raised to incandescence. The ions produced by chemical means or by a flame are much larger than those produced by radiations. This is shown by their much smaller mobilities. They probably consist of aggregates of a considerable number of molecules.—BIBLIOGRAPHY: W. C. D. Whetham, *Theory of Solutions*; J. S. Townsend, *Electricity* *in Gases*; J. A. Crowther, *Ions, Electrons, and Ionizing Radiations.*

I'ophon, Greek tragic poet, a son of Sophocles. He is said to have gained the second prize in a contest with Euripides and Ion in 428 B.C. Of his plays, fifty in number, only a few lines are extant.

I O U (= I owe you), an acknowledgment of debt. Its form is generally as follows:

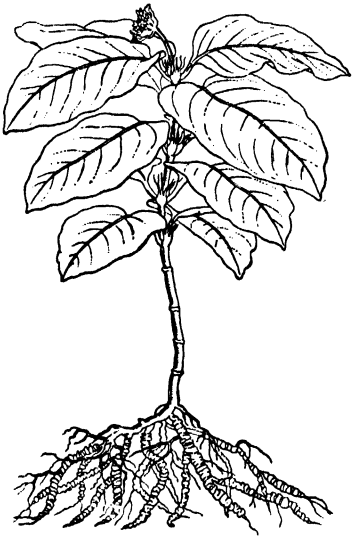
" Place and Date.
" To A. B.,
" I O U Five pounds sterling.
" (Signed) C. D."

So worded, it is neither a promise to pay nor a receipt, and is not liable to stamp duty. In an action for payment, it is evidence of the debt.

I'owa, one of the central United States, bounded on the north by Minnesota; east by Wisconsin and Illinois, from which it is separated by the Mississippi; south by Missouri; and west by Nebraska and South Dakota, from which it is separated by the River Missouri; area, 56,147 sq. miles. It is well watered, its streams being all affluents of the large rivers which bound it on the west and east. To the Mississippi flow the Wapsipincon, Iowa, Cedar, Skunk, and Des Moines, with a general south-easterly course. To the Missouri flow the Big and Little Sioux and other streams. The surface is undulating, nearly four-fifths being arable and included in ranches. The climate is very healthy, and winter continues from December to March; the summer heat is tempered by frequent showers. The soil is in general very good, consisting of a deep black mould, intermingled in the prairies with sand, red clay, and gravel. The eastern portion is rich in minerals. Lead is wrought to a considerable extent, and zinc, iron, and coal are found. The coal-fields cover an area of 19,000 sq. miles, and the yearly output is more than 7,000,000 tons. Limestone, gypsum, and clay are abundant. The area occupied by forests and woodland is over 5,000,000 acres. Iowa is a great agricultural state, producing immense quantities of Indian corn, wheat, and oats, and also stands high in regard to dairy farming. Other industries include the manufacture of farm implements, flour-milling, pork-packing, machinery, and smelting-works. The length of railways open for traffic is over 10,000 miles, not including about 1000 miles of electric lines. It possesses exceptional advantages for river trade, and the smaller streams supply abundant water-power. Education is well attended to. There is a State university (at Iowa City), besides the Drake University at Des Moines, the Upper Iowa University at Lafayette, and a flourishing State College of Agriculture. The settlement of Iowa began in 1833, when the first purchase of land from the Indians took place; its territorial government was instituted in 1838, and it was admitted into the Union in 1846. The capital is Des Moines (pop. *c.* 126,468); the principal towns being Sioux City, Dubuque, Davenport, Burlington, Council Bluffs, Cedar Rapids, Keokuk, and Ottumwa. Pop. (1920), 2,403,630. There is an Indian reserve of about 4000 acres. Pop. *c.* 300.

Iowa City, a city in the United States, capital of Johnson county, Iowa, on the River Iowa, at the head of the navigation. The city was founded in 1839, contains the State University, and was the state capital from 1839 to 1857. Pop. 10,700.

Ipecacuanha, *Psychotria* (*Cephœlis*) *Ipecacuanha*, a small Rubiaceous plant, found wild in Brazil, and cultivated there and in the Straits Settlements. The thickened roots contain about 2½ per cent of alkaloids (emetine, cephæline, and psychotrine), and furnish a valuable drug, *Ipecacuanhæ radix*, largely used as an expectorant in bronchitis, croup, and whooping-cough.



Ipecacuanha Plant

Iphigenia (if-i-je-nī'a), in Greek legend and poetry, daughter of Agamemnon and Clytemnestra. To avert the wrath of Artĕmis, whom Agamemnon had enraged, and who detained at Aulis the Greek fleet that had been prepared for the Trojan War, Iphigenia was to be sacrificed on the altar; but a stag was miraculously substituted for her, and she was conveyed in a cloud to Tauris. She became priestess there to Artĕmis, and saved her brother Orestes when on the point of being sacrificed. The story of Iphigenia is the subject of two plays by Euripides, and of one by Racine and another by Goethe.

Ipomæ'a, a large genus of plants of the nat. ord. Convolvulaceæ, consisting mostly of twining prostrate herbs, widely distributed in warm regions. The species of most importance is *I. Purga,* which yields the jalap of commerce. See *Jalap.*

Ipsam'bul, Abusam'bul, or **Abusim'bel,** a village of Nubia, on the left bank of the Nile; remarkable for an enormous cliff temple begun by Pharaoh Seti I, who died in 1292 B.C., and finished by his son Rameses II. The colossal sitting statues of Rameses and his wife are most impressive. On the front of the temple is a record of the visit of the Hittite king after a peace treaty had been arranged. On one of the colossi of Rameses is a record in Greek of the visit of Psamtik II, who succeeded Necho in 593 B.C.

Ipswich (ip'swich), a parliamentary, county, and municipal borough of England, capital of Suffolk, on the Orwell. The public buildings include a fine town hall, a post office, a customhouse, county court-house, cavalry barracks, and theatre. The industries embrace agricultural implements, machinery, artificial stone, artificial manure, silk, tanning, ropes, lime and cement, brewing, and shipbuilding. Ipswich is a town of great antiquity. It was originally called Gippeswich, from the neighbouring River Gipping. King John gave it its first charter. In 1906 a cemetery dating from the fifth century was discovered at Ipswich, and various objects of antiquity unearthed. The French villages of Bazentin-le-Grand, Bazentin-le-Petit, and Fricourt were adopted by Ipswich. From 1295 to 1918 it returned two members to Parliament, but now sends only one. Pop. (1921), 79,383.

Ipswich (ip'swich), a town of Queensland, Australia, on the River Bremer, 23½ miles west of Brisbane, in a mining, manufacturing, and agricultural district. There are large railway workshops and coal-mines there. Pop. (with suburbs), 25,000.

Iquique (i-kē'kā), a seaport of Chile, province of Tarapacá, formerly a fishing-village, but now a considerable town with an important trade, its rise being due to the extensive deposits of nitrate of soda and borax, and the silver-mines, &c., in its neighbourhood. The town formerly belonged to Peru, but was handed over to Chile in 1883. It has suffered much from earthquakes, and also from more than one serious fire. Pop. (1919), 47,677.

Iquitos (i-kē'tōs), a Peruvian town, department of Loreto, on the Marañon, or Upper Amazon, with an active trade, exporting much rubber. Pop. 14,000.

Irak Aj'emi, an interior province of Persia, separated from the Caspian Sea by Ghilan and Mazanderan; area, about 138,000 sq. miles, a large part of which in the east is occupied by salt deserts, the rest being largely mountainous, with some fine valleys and rich plains. The chief towns are the capital, Teheran, and Ispahan. Pop. about 2,500,000.

Irak Ar'abi, a state of Mesopotamia, lying between the Rivers Tigris and Euphrates, corresponding nearly to the ancient Babylonia. The district was mandatory to Great Britain, who proclaimed Emir Feisul as King. See *Hejaz.* Pop. about 2,000,000.

Iran, or **Eran** (O.Pers. *Aryana*; Zend, *Airyana,* that is, land of the Aryans), the name given by the ancient Persians to their native land, and still used by the modern Persians, though it is also employed in a wider sense to designate the whole of the country from the Indus to the Tigris, in contradistinction to Turan, the name often employed as synonymous with Turkestan.

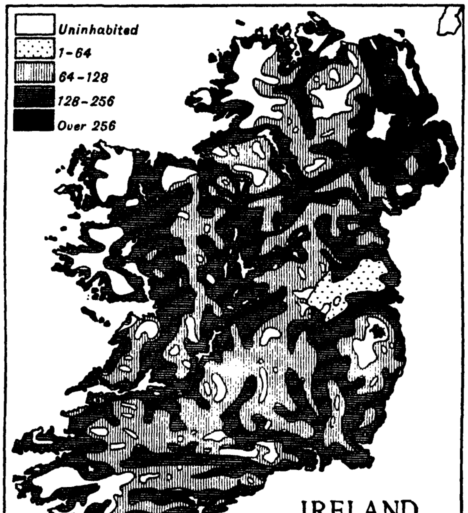
Iranian Languages, a family of languages belonging to the Indo-European stock, closely allied to the Indian group, and called by some philologists Persian, from the best-known member of the family. The two oldest-known Iranian languages are the Old Persian of the cuneiform inscriptions and the Old Bactrian or Zend, the latter the language in which the *Zend-avesta* or sacred writings of the Parsees is composed. The Middle Iranian languages are the Pehlevi, and still later the Parsee, which are preserved in the commentaries to the *Zend-avesta.* The latter approaches pretty closely to the modern Persian. The most important of the New Iranian languages is the modern Persian, in which has been produced a very rich and celebrated literature. The Afghan or Pushtu, and the dialects of the Kurds, form separate branches of the Iranian family.

Irawadi or **Irrawad'dy,** a large river traversing Upper and Lower Burmah from north to south, falling into the Indian Ocean by various mouths and forming a great delta. Its sources are in lat. 28° N., in mountains between Burmah and Eastern Tibet. The Irawadi is the main artery of Burmah, much trade is carried on by its means, the valleys through which it flows are very fertile and populous, and on its banks are the principal towns (Mandalay, Ava, &c.), with Rangoon and Bassein on two of its mouths. The width of the river varies from 200 yards above Ava to 1 to 4 miles towards its delta, and the total length is estimated at 1200 miles. It is navigable for steamers of 5 feet draught as far as Bhamo near the Chinese frontier, 900 miles from its mouth. The Irawadi Flotilla Company possesses a large number of steamers specially constructed for the navigation of this river.

Ir′bit, a town in Russia, in the government of Perm, on the frontiers of Siberia, at the confluence of the Irbit and the Niza. It is noted for a great annual fair, dating from the seventeenth century, and held in the month of February. Pop. 20,000.

Ireland, William Henry, son of a London bookseller and publisher (author of various illustrated works), born in 1777, died 1835. He imposed spurious Shakespearian MSS. upon his father, who was a Shakespeare enthusiast, and also upon other men of letters, and produced two ‘ Shakespearian ’ plays, *Vortigern* and *Henry II*, the former of which was purchased by Sheridan and acted at Drury Lane, but was a complete failure. The criticisms of Malone led to the exposure of the fraud, which was acknowledged by Ireland in 1796. Several novels and poems proceeded from his pen, besides his *Confessions* (1805), containing an account of his forgeries.—Cf. James Payn, *The Talk of the Town*.

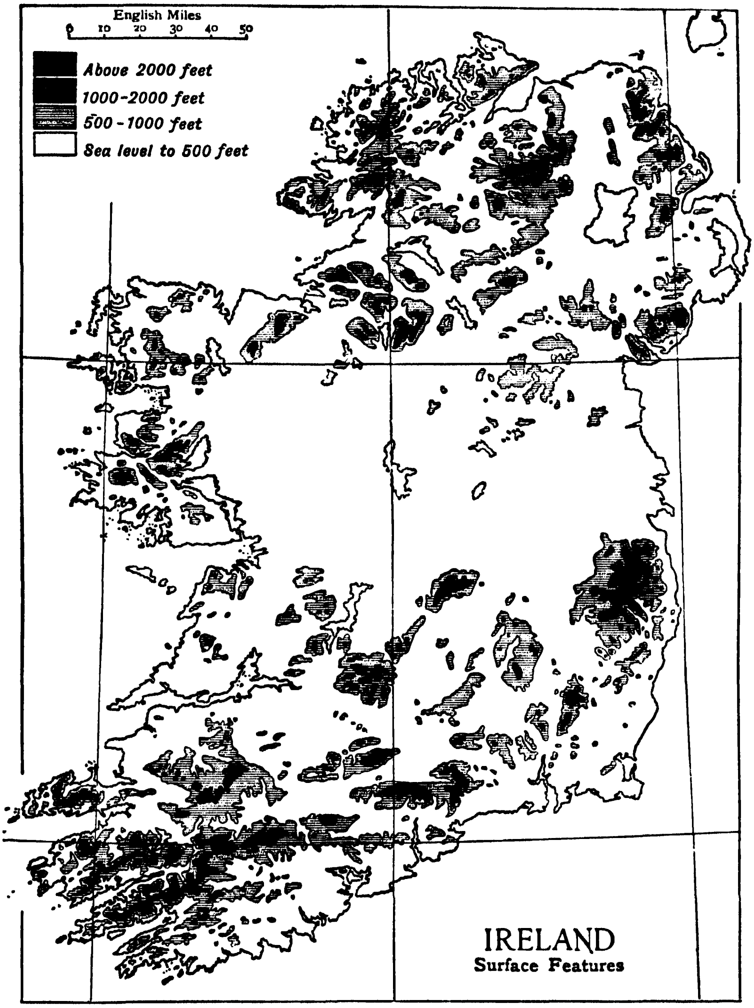
Ireland, Old Fr., *Heriu*, Modern Ir., *Erin*; in Lat., *Hibernia*), the more western and smaller of the two principal islands of which the British Isles are composed, is separated from Great Britain on the east by the Irish Sea, and surrounded on all other sides by the North Atlantic Ocean. Measured diagonally, the greatest length, from Mizen Head in the south-west to Fair Head in the north-east, is 300 miles; and the greatest breadth, from Carnsore Point in the south-east to Benwee Head in the north-west, is 212 miles; the central breadth, nearly between the bays of Dublin and Galway, is 110 miles. The area is 32,551 sq. miles. Ireland is divided into the four provinces of Leinster, Ulster, Munster, and Connaught, and into thirty-two counties. These, with their areas and populations, are as follows:



Provinces and Counties.	Area in sq. m.	Pop. in 1901.	Pop. in 1911.
Leinster—	**7,626**	**1,152,829**	**1,162,044**
Carlow	346	37,748	36,252
Dublin	354	448,206	477,196
Kildare	654	63,566	66,627
Kilkenny	800	79,159	74,962
King's County ..	772	60,187	56,832
Longford	421	46,672	43,820
Louth	317	65,820	63,665
Meath	905	67,497	65,091
Queen's County ..	664	57,417	54,629
Westmeath	710	61,629	59,986
Wexford	901	104,104	102,273
Wicklow	782	60,824	60,711
Munster—	**9,522**	**1,076,188**	**1,035,495**
Clare	1,332	112,334	104,232
Cork	2,890	404,611	392,104
Kerry	1,859	165,726	159,691
Limerick	1,064	146,098	143,069
Tipperary	1,661	160,232	152,433
Waterford	716	87,187	83,966
Ulster—	**8,569**	**1,582,826**	**1,581,696**
Antrim	1,192	544,795	580,811
Armagh	512	125,392	120,291
Cavan	746	97,541	91,173
Donegal	1,871	173,722	168,537
Down	958	206,364	204,303
Fermanagh	715	65,430	61,836
Londonderry	816	144,404	140,625
Monaghan	499	74,611	71,455
Tyrone	1,260	150,567	142,665
Connaught—	**6,834**	**646,932**	**610,984**
Galway	2,374	192,549	182,224
Leitrim	613	69,343	63,582
Mayo	2,157	199,166	192,577
Roscommon	984	101,791	93,956
Sligo	706	84,083	79,045
Total	**32,551**	**4,458,775**	**4,390,219**

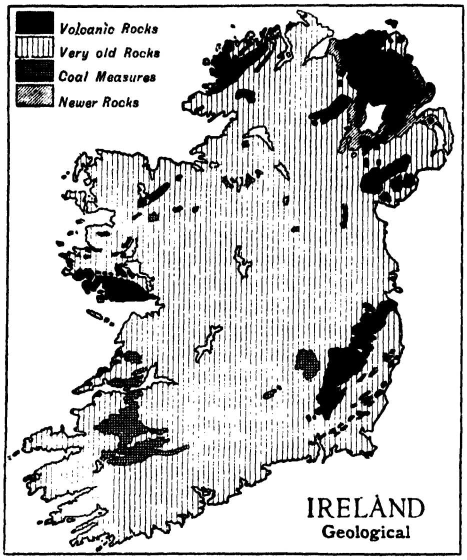
The population in 1841 was 8,175,124; in 1851, 6,552,385, the decrease being partly owing to the famine resulting from the potato disease in 1846–7, and partly to emigration. Since 1851 over 4,000,000 emigrants have left the country. Pop. in 1891, 4,704,750; in 1911, 4,390,219. Owing to the state of the country, no census was taken in 1921. The capital is Dublin; the other chief towns are Belfast, Cork, Limerick, and Londonderry.

Surface.—The coast, forming a line of nearly 3000 miles, is, in general, bold and rugged, and is diversified by numerous indentations, some of which run far into the land and form excellent natural harbours. There are a considerable number of islands, chiefly on the west coast, the largest being Achill. The mountains, generally speaking, rise in isolated masses at a short distance from the coast, the interior having the form of a vast plain, in which are extensive tracts of bog. The Macgillicuddy's Reeks, in the south-west, are the highest, the culminating summit being Carrantual, 3414 feet. The mountains of Wicklow, in the south-east, reach the height of over 3000 feet (Lugnaquilla is 3039 feet). Rivers are not only numerous but are very equally distributed over the surface. The Shannon, the largest river, is navigable to its source in Lough Allen, forming a water-way of 240 miles. The other rivers of most importance are the Bandon, Lee, Blackwater, Suir, and Barrow, which enter the sea on the south, the last two by the union of their streams forming the broad estuary of Waterford Harbour; the Slaney, in the south-east angle, which expands into Wexford Haven; the Liffey and the Boyne, entering the sea on the east, the former having the capital at its mouth, the latter being the largest river which discharges itself into the Irish Sea on the east coast; and the Bann and the Foyle, which have their mouths at no great distance from each other on the north coast. Ireland possesses a vast number of lakes (or loughs). Lough Neagh, in the north-east, is a quadrangular expanse 17 miles long by 10 miles broad, and is the largest lake of the United Kingdom. The other more important lakes are Lough Erne, also in the north; Lough Corrib, in the west, and connected with it by a subterranean channel Lough Mask; Lough Conn, also in the west; and Loughs Allen, Ree, and Derg—the first the commencement, and the other two wide expansions of the Shannon. Besides these there are many



others, among which the lakes of Killarney, in the south-west, are pre-eminent for beauty, and attract numerous visitors.

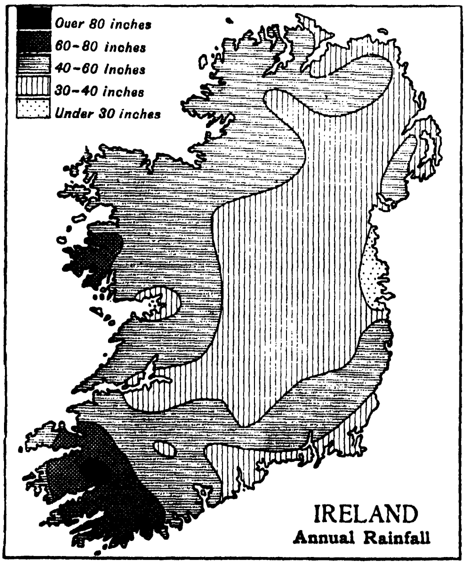
Geology and Minerals.—The mountains are formed of vast masses of primary and metamorphic rocks, while the secondary formations spread over the interior. Basaltic rocks are almost entirely confined to the north-east, where they often form colonnades, of which the Giant's Causeway is a celebrated specimen. Granite has its largest development in the south-east, where it forms the great mass of the mountains of Wicklow. It is more sparingly developed in the west and north-west (Donegal), as well as in the north-east. The lower rocks of the Silurian system form no inconsiderable portion of the whole island, covering large portions of the north-north-east and south-west as well as parts of the west. The Old Red Sandstone has its largest continuous development in the county of Cork, but rises to the surface at numerous isolated spots. The rocks next in the series belong to the Carboniferous system; at the bottom of which lies the Mountain Limestone, the most largely developed of all the rocks of Ireland, occupying almost the whole of the interior. In some cases, particularly in the south-west, the coal-measures occupy considerable areas, but the quality of the coal is generally very inferior, and it is worked only to a very small extent, the yearly output being only about 100,000 tons. The strata higher in the geological series than the coal are very partially developed. Of other minerals than coal Ireland yields small quantities of iron ore, lead ore, slate, alum, and salt.



IRELAND
Geological

Climate.—The climate is on the whole moister, milder, and more equable than that of the greater part of Britain. It is highly favourable to vegetation, and allows plants to winter in the open air that can do so in very few places in Britain; some species of plants also being peculiar to Ireland alone of the British Isles, as, for instance, the strawberry tree or arbutus, found in the south-west.

Agriculture.—As regards agriculture Ireland has great advantages, for though there is a great extent of moorland, there is also a vast area of arable surface, covered with a deep friable loam of remarkable richness. Notwithstanding, agriculture on the whole is in a backward state, a result largely due to the smallness of the holdings, and to the evils of overcropping. However, a steady diminution has taken place in the number of very small holdings in recent years, especially since 1909. The rearing of live stock and dairy-farming are largely carried on, and the latter has become more prosperous since the farmers have been working on the co-operative principle. By far the largest grain crop is oats; the chief green crop is potatoes, which cover an area about one and a half times as large as in England. Potatoes had become the main food of the people by the end of the seventeenth century, and a potato famine occurred as early as 1739. Little wheat is grown, only about as much as in Wales; but oats cover a larger area than in Scotland. Another staple crop (in the north) is flax. Many



IRELAND
Annual Rainfall

improvements were introduced in the Land Act of 1881, the main provisions of which are known under the terms 'fair rent', 'fixity of tenure', and 'free sale'. By the first of these, any tenant objecting to his rent, or the rent the landlord wishes to exact, may have a 'fair rent' fixed for him by a court, this rent to remain unaltered for fifteen years. By 'fixity of tenure' the law recognized that the tenant has a certain right in his holding in virtue of which he is not to be arbitrarily removed without compensation, and which enables him on leaving his farm to obtain the best price he can by the 'free sale' of this right of tenancy. At the end of fifteen years the landlord may resume possession of the holding on paying the tenant compensation for improvements and also the value of his tenant-right. This and other Acts being judged insufficient to serve as a settlement of the land question, an Act was passed in 1903 to enable tenants to purchase their holdings and to encourage owners to sell, the necessary funds, to the extent of £112,000,000, to be advanced on State guarantee. Many holdings were thus purchased by the tenants. Under the Land Act of 1909 the Congested Districts Board was reconstituted and the area of its work extended. Compulsory powers of purchase were also given to the Board.

Industries and Trade.—Of industrial employments the linen manufacture is the chief and is in a flourishing condition. Belfast, its centre, famous also for shipbuilding, has become the first city of Ireland. The woollen manufacture at the outset outstripped that of linen; but it was hampered by unjust restrictions imposed by Parliament at the instance of the woollen manufacturers of England. The brewing of porter and distillation of whisky form important industries. The fisheries employ a considerable number of persons, but might with advantage employ more. The salmon fisheries are valuable, and are increasing in value. The trade is only of a moderate bulk. The main articles of export consist of agricultural produce, the greater part of which finds its market in Great Britain. These articles include grain, live stock, salt and fresh meat, eggs, and butter. Of manufactured articles linen is the chief export; whisky and porter are also exported. The direct trade with foreign countries is inconsiderable. The inland trade is much facilitated by the rivers and canals, on the improvement and construction of which respectively large sums have been spent. The railway system, although disproportionate to that of England or of Scotland, has attained a total length of over 4000 miles.

Religion. — The prevailing religion is the Roman Catholic. The Reformation never made much progress, and though the Protestant Episcopal Church was established by law it was only the Church of a small minority. In 1869 an Act was passed for its disestablishment. Previously the clergy were supported by a tithe rent-charge, the proceeds of the Church lands, &c., but by an Act which took effect from 1st Jan., 1871, the property and tithes formerly belonging to the Church were vested in commissioners, who had charge of the winding up of the Church's financial affairs, and their powers were in 1881 transferred to the Irish Land Commission. Part of the funds thus liberated has been expended on education and the relief of distress. The Irish Church has still a fund of its own, which in 1919 amounted to £9,569,300. Its affairs are now managed by diocesan synods and the General Synod in conjunction with a representative body. The supreme legislative powers reside in the General Synod, which meets in Dublin, and is composed of the Archbishops of Armagh and Dublin and the eleven bishops, and of lay and clerical representatives from the different dioceses, the lay representatives being more than twice as numerous as the clerical. The representative body consists of the archbishops and bishops *ex officio*, thirty-nine lay and clerical elected members (three for each diocese), and thirteen co-opted members elected by the other two classes conjointly. At the head of the Roman Catholic Church are four archbishops, who take the title of Armagh, Dublin, Cashel, and Tuam, and twenty-four bishops. The whole of the Irish Roman Catholic clergy are supported solely by voluntary contributions. The number of priests in 1919 was about 3830, more than half being curates. There are numerous monasteries and convents. The Presbyterian Church is chiefly confined to Ulster, where it may be said, especially in the counties of Down and Antrim, to be the leading religious denomination. Its ministers are supported by voluntary contributions, seat-rents, and church funds. They were formerly aided by an annual grant from Government, called the *Regium Donum*, the amount of which paid in 1869 was £40,547. This grant was abolished by the Irish Church Act of 1869, and was commuted to a single sum of £701,372 paid to the Church. According to the census of 1911 there were in Ireland 3,242,670 Roman Catholics, 576,611 Episcopalians, 440,525 Presbyterians, 62,382 Methodists, and 68,031 members of other persuasions.

Education. — The chief educational institutions are Dublin University (q.v.); the National University of Ireland, with university colleges at Dublin, Cork, and Galway; and Queen's University, Belfast. The National University and that at Belfast were instituted under an Act of 1908; previously the colleges at Belfast, Cork, and Galway were attached to the Royal University of Ireland, which carried out examinations and conferred degrees. The Royal College of Science supplies a complete course of instruction in science applicable to the industrial arts. The Catholic University of Ireland was established in 1845, with colleges at Maynooth and elsewhere in connection with it. The colleges or seminaries for the education of the Catholic priesthood are numerous, the most prominent being that at Maynooth, founded in 1795, and formerly receiving annually from Government £26,360, for which, by the Irish Church Act of 1869, a sum of £372,331 was paid in compensation. The General Assembly's Theological College, Belfast, and the Magee College, Londonderry, are Presbyterian colleges. The chief elementary schools are those under the superintendence of the Commissioners of National Education, and in 1917 there were over 8000 primary schools in operation. In 1878 an Act was passed setting apart £1,000,000 from the Irish Church surplus fund for the promotion of intermediate secular education by special examinations, prizes, &c. The interest on this capital sum was afterwards supplemented by an annual sum of £46,567 provided under the Revenue Act, 1911.

Government.—Ireland, by the Act of Union, became in 1801 an integral part of the United Kingdom, and until 1920 shared in its legislation by means of twenty-eight representative peers in the House of Lords, and 103 representatives in the House of Commons. The representative peers were elected for life by the whole body of Irish peers. The Lord-Lieutenant, who represented the sovereign, was the head of the Executive, and held his court in Dublin Castle. Until 1921 the office was only open to Protestants, when Viscount Fitzalan became the first Roman Catholic Lord-Lieutenant. The Lord-Lieutenant was assisted by a Privy Council and a Chief Secretary, who took the most active part in the administration of affairs. As in England, the chief legal functionaries were a lord chancellor, a lord chief-justice, and a master of the rolls. The Irish police force was a semi-military body, paid out of the Consolidated Fund. In Dec., 1920, the Better Government of Ireland Act was introduced, and important changes were made in Ireland. The Act provided for the establishment of two Irish Parliaments for Northern and Southern Ireland respectively, and of a Council of Ireland " with a view to bringing about harmonious action between the Parliaments and Governments of Southern and Northern Ireland ". The House of Commons of Southern Ireland was to consist of 128 members, and that of Northern of 52 members. In addition 40 members were to be sent to the Parliament of the United Kingdom. The Council was to consist of a President appointed by the king, and of delegations of twenty members from each of the two Irish Parliaments. The Act also provided for the establishment of High Courts of Justice for Northern and Southern Ireland, and of one general Court of Appeal. The office of Lord-Lieutenant was opened to Roman Catholics. Ireland was to contribute £18,000,000 a year to imperial expenditure, 56 per cent to be apportioned to Southern Ireland, and 44 per cent to Northern Ireland.

History.—The beginning of the history of Ireland is enveloped in fable. As in Western Europe generally, the earliest inhabitants are believed to have been of Iberian race, and therefore akin to the modern Basques. They were followed by the Celts, different tribes of whom probably arrived at different times, giving rise to such names as Firbolgs, Milesians, &c. Among these the Scots were the latest, and subsequently got the upper hand, so that their name became generally applied to all the inhabitants. There is no evidence that the Irish had the use of letters before the middle of the fifth century, when Christianity and Christian literature were introduced by St. Patrick. Subsequently Ireland became the seat of Western learning; and its monasteries were the schools whence missionaries proceeded throughout continental Europe. Its internal condition, however, was far from satisfactory. Divided among a number of hostile kings or chiefs, it had been long torn by internal wars, and for nearly two centuries ravaged by the Danes, numbers of whom settled in the country, when, in the beginning of the eleventh century, Brian Boroimhé united the greater part of the island under his sceptre, restored tranquillity, and subdued the northern invaders.

After the death of Brian at the close of the battle of Clontarf, 1014, gained against the Danes and their Irish allies, the island relapsed into its former state of division and anarchy. In this state of matters Henry II of England obtained a Papal Bull giving him the right to subdue it, and the way was paved to this when Dermot, Prince of Leinster, who had been driven from the country, was reinstated by the aid of Richard de Clare (Strongbow) and other Norman nobles. In 1172 Henry entered Ireland himself, and partly through the favour of the clergy and his affability, the great princes did homage to him and acknowledged his supremacy. Many Norman barons and their followers now settled in the country, but the English power was far from being established over it. For long only a part was recognized as English territory (generally known as ' the Pale '), and this was governed by various nobles, subject to a Viceroy. The nobles quarrelled among themselves, and were very often at open feud. In 1315 Edward Bruce, brother of the Scottish king, landed at the head of a large force, and was crowned king, but was defeated by the English in 1317 near Dundalk. The English power was greatly reduced by this expedition, however, and a number of the barons renounced their allegiance to England, and adopted the Irish language, laws, manners, and customs. This led to the passing of the Statute of Kilkenny (1367), forbidding, under severe penalties, intermarriages between English and Irish, the assumption of Irish names by persons of English blood, and the use of the Irish language or the native (Brehon) law. But the English rule became so weak that the Viceroy found it necessary to protect the Pale by payments of money to the Irish chiefs, and this state of matters long continued. In the reign of Henry VII (1495) was passed Poynings' Act (so called from Sir Edward Poynings, Lord-Deputy of Ireland), which provided that all former laws passed in England should be in force in Ireland, and that no Irish Parliament, that is the Parliament of the English settlers, should be held without previously stating the reasons why it was to be summoned, and the laws it was intended to enact. At the beginning of the sixteenth century the greater part of the island still remained unconquered by the English. The native Irish lived according to their old customs under their own chiefs, and in manners and mode of life were still totally uncivilized.

Henry VIII assumed (by Act of the Irish Parliament) the title of King of Ireland, instead of *Lord*, which he had before borne as a vassal of the Pope, and the Irish chiefs generally acknowledged his authority; but the change of religion was bitterly opposed, and Mary was easily able to undo all that had been done in this direction by her two predecessors. Elizabeth imposed a Protestant clergy upon the people, and her reign was marked by a series of risings, which terminated in the reduction of the whole island. Great stretches were taken from the Irish chiefs, and distributed among English noblemen and others, who were to settle their new estates with English farmers. Little was done in this way, however, compared with the great plantation of the North by James I, under whom 800,000 acres of land in Ulster were declared forfeited, a large part of this being entirely withdrawn from the Irish, and divided among Scottish or English settlers. In 1641 there began an attempt to shake off the English yoke, in which great numbers of the settlers were massacred by the native Irish. In 1649 Cromwell was appointed Lieutenant, and energetically, but cruelly, reduced the whole country within nine months. The next struggle was that which followed the Revolution, when James II landed in 1689, and hoped to regain his crown by French and Irish aid. He failed to reduce Londonderry, which held out, enduring the extremity of famine, till it was relieved by some ships from England. In the following year (1690) William III arrived, and on the 1st of July gained a decisive victory over the forces of James on the Boyne, near Drogheda. In 1691 another victory was gained over the Irish at Aughrim in Galway, and in October Limerick, the last place that held out for James, capitulated, a treaty being concluded at the same time, by which the Catholic Irish were to be allowed the free exercise of their religion. The Treaty of Limerick was ill kept by the English. By a decree of Parliament upwards of 1,000,000 acres were confiscated and divided among Protestants. Cruel penal laws were passed against those who adhered to the Catholic religion. The Catholic ecclesiastical dignitaries were banished; the subordinate priests were not allowed to leave their counties; no Catholic could hold a public office, acquire landed property, or enter into a marriage with a Protestant.

Although these laws were not always rigorously carried out, yet they excited great bitterness of feeling, and produced frequent revolutionary associations (*Whiteboys* and others), which mark the history of Ireland. In 1778 the penal laws against the Catholics, though not repealed, were made much more lenient. Catholics were henceforth permitted to acquire landed property, to erect schools, and to observe their own religion under fewer restrictions. In 1782 Poynings' Act was repealed, and freedom of legislation allowed to the Irish, though Catholics were still excluded from Parliament, and did not even have the franchise till 1793. The French Revolution had a great effect on the minds of the Irish people, and it was partly through this influence that the Society of United Irishmen was formed, and that rebellion broke out in 1798. Great atrocities were perpetrated, but the rising was speedily crushed. A body of French soldiers, 1500 strong, landed in Killala Bay, but were compelled to surrender.

The British Government now resolved to unite the Irish and British Parliaments, and an Act providing for the legislative union of the two countries passed the Irish Parliament in May, 1800, and the British Parliament in July of the same year, in virtue of which the union was effected on the 1st of Jan., 1801. But although this measure bound the destinies of the two countries still more closely, yet it was far from putting an end to the troubles which had so long divided them. In 1829, mainly through the efforts of O'Connell, the Catholic Emancipation Act was passed, under which Catholics could take a seat in Parliament, and were admitted to most public offices. (See *Catholic Emancipation.*) The Irish National party now tried to repeal the

Union, for which purpose O'Connell founded the Repeal Association. This movement collapsed in 1843, and afterwards the potato famine in 1845, and again in 1846, cast all other interests into the background. To mitigate this calamity Parliament granted enormous sums of money; yet thousands died from starvation, and hundreds of thousands emigrated to America. Anarchical outbursts, agrarian murders, and other acts of violence distracted the land. Meanwhile O'Connell died, and his party was replaced by one still more revolutionary, called the Young Ireland party. In these circumstances the French Revolution in 1848 had a great effect upon Ireland. The leaders of the Young Ireland party, Smith O'Brien, Mitchel, Duffy, Meagher, and others, entered into relations with the Provisional Government at Paris, and the people began openly to exercise themselves in the use of arms. But the rebellion turned out a mere fiasco. After the famine and great emigration a general improvement became visible among the inhabitants. Agriculture revived, and the manufacturing industries began to compete with those of England.

The year 1865 witnessed a new conspiracy designed to separate Britain and Ireland. This originated in the United States, when the numerous Irish during the Civil War in that country hoped for a rupture between it and Britain, of which they might take advantage. This conspiracy, the members of which called themselves *Fenians* (q.v.), soon spread to Ireland; but before they could take any overt action in that island their design was stifled by the British Government (1865–6). The ministry now resolved to do all in their power to render the Irish people loyal and contented; and accordingly the Irish Church was disestablished by the Act of 1869, an Act to improve the tenure of land being passed in 1870.

In 1871 an agitation for what was called Home Rule was set on foot. Its chief supporters, designated ' Nationalists ', professed not to desire the severence of Ireland from Britain; what they mainly wanted was to have an Irish Parliament for matters exclusively Irish. In 1880 Ireland became the scene of an agitation carried on mainly by a body known as the Land League. The movement was so lawless that two special Acts, a ' Coercion ' Act and a Peace Preservation Act, were passed. Still further to redress Irish grievances a Land Act was also passed in 1881, the chief provisions of which have already been mentioned. The Land League was suppressed, but a body called the National League was soon organized in its place. In 1885, eighty-six Nationalist members (under the leadership of Parnell) were returned to Parliament, and their pressure on the Government led to Gladstone's scheme in 1886 by which Ireland was to receive a Parliament of her own and the Irish members to be withdrawn from the Imperial Parliament. This and the accompanying scheme for the buying out of Irish landlords were rejected by Parliament and the majority of the constituencies, thus bringing a Conservative Government under Lord Salisbury into power. (See *Britain.*) A permanent Act for the repression of crime was passed in 1887, and an Act (Lord Ashbourne's) for the benefit of Irish tenants. A Home Rule Bill passed the Commons but not the Lords in 1893. The Local Government Act of 1898 established local councils similar to those in Great Britain. The Land Purchase Act of 1903 was intended to put an end to dual ownership, by enabling tenants to buy their farms. In 1912 Mr. Asquith brought in another Home Rule Bill, but Protestant Ulster protested and declared that this province must be excluded from the operation of the Act. The result was the Ulster Covenant (see *Covenant*), the forming of the Ulster volunteers under Sir Edward Carson, and the organization of the National volunteers in the south. Thus matters stood in 1914, when the prospect of passing the Home Rule Bill was threatened by the determined attitude of both sides, Nationalist Catholic Ireland and Protestant Ulster. A conference, called by King George at Buckingham Palace for the purpose of an amicable adjustment, failed in its efforts, and feeling was running high. In the meantime the European War broke out, and on the 4th of August John Redmond, the leader of the Irish Nationalists, declared that Ireland would support England and the Allies in the great ensuing struggle. For two years Ireland remained faithful to the pledge; Irish soldiers joined the British army and fought bravely on the battlefields of Flanders and France. The old feud between Ireland and England seemed to have been forgotten. The truce, however, was not of long duration. In 1916 the Easter risings at Dublin marked a turning-point in the history of Ireland. An attempt was made to land arms and ammunition in Ireland by a vessel disguised as a neutral merchant ship, but in reality a German auxiliary. On 24th of April serious disturbances broke out in Dublin, and the rebels made an attack on Dublin Castle. The situation was very serious, and martial law was proclaimed over the whole of Ireland. The Sinn Feiners, on the other hand, called upon the people of Ireland to rally to the support of the Provisional Government of the Irish Republic. Several rebel leaders were sentenced to death and others to penal servitude.

In April, 1918, after the March offensive, the British Government was obliged to impose new military burdens upon the people, and declared that the Irish people would be called upon to do

their part. The Government promised at the same time to put Home Rule into effect, but the difficulties were great. Whilst the men of Ulster still denied the right of any one to force them to accept Home Rule, the Catholics organized a movement against obligatory military service. In May trouble again broke out in Ireland. Lord French had succeeded Lord Wimborne as Lord-Lieutenant, and soon a dangerous conspiracy was discovered in the country. The Lord-Lieutenant posted a Proclamation declaring that strict measures would be taken to put down the plot, and on the same day some 150 Sinn Feiners were arrested under the Defence of the Realm Act. The Sinn Fein movement, however, continued to make progress, and Mr. John Dillon, who had succeeded Mr. Redmond as leader of the Nationalist party, seemed to have lost all control in Ireland. The British Government, after having declared that it would apply conscription to Ireland and put Home Rule into effect, ultimately had to renounce both measures. Various solutions were put forward and discussed in Parliament, one of these being the idea of including Ireland as a confederate state in the great Imperial Federation to be created after the war. The attitude of Sinn Fein, however, remained irreconcilable, and in the general election of Dec., 1918, the Sinn Feiners carried seventy-three seats. The elected members were pledged to abstain from taking their seats in Westminster. They remained in Ireland, and in Jan., 1919, held a meeting at Dublin, when they constituted themselves as *Dail Eireann,* the Irish Parliament, issued a declaration of independence and of the establishment of an Irish Republic, with De Valera (a Spanish-American) as President, and Arthur Griffith (a Welshman) as Vice-President, and finally demanded the evacuation of Ireland by the 'foreign garrison'. The British Government at once took measures to repress the movement, and the Irish, especially the extremist wing of Sinn Fein, retaliated by murdering constables and British Crown officials. The number of British troops in Ireland was increased, and the result was a series of riots, murders, reprisals, and counter-reprisals. In Dec., 1920, a measure of Home Rule was at last passed by the British Government, but it had little effect upon the state of affairs in Ireland. Numerous attempts to bring about a settlement and truce failed. In July, 1921, however, the Sinn Fein leaders accepted the invitation of the Government to come to London for the purpose of discussing the basis of a compromise and a final settlement of the Irish question. The conference between the British Government and the Sinn Fein leaders began on 11th Oct., 1921, and, after the negotiations had almost fallen through, an agreement was come to at 3 a.m. on Tuesday, 6th Dec., 1921. By this agreement Ireland is to be known as the 'Irish Free State', and is to be given dominion home rule. Northern Ireland has the option of remaining out of the Irish Free State. A week later the British Parliament approved the treaty, with only 58 dissentients in the Commons and 47 in the Lords. After much bitter dissension An Dail Eireann ratified the treaty on Saturday, 7th Jan., 1922, by 64 votes to 57. The Sinn Fein party was split in two, one section, under Mr. Griffith, who was elected President of Dail Eireann on 10th Jan., 1922, being in favour of the terms of the treaty, while the other section, under Mr. De Valera, is content with nothing less than an Irish Republic and total separation from Britain. On 21st Jan. a meeting took place between Sir James Craig, the Premier of Northern Ireland, and Mr. Michael Collins, the head of the Provisional Government of Southern Ireland, to consider the three questions of Boundary Commission, the Belfast boycott, and the Council of Ireland.—Bibliography: E. A. D'Alton, *History of Ireland from the Earliest Times to the Present Day*; J. F. Boyle, *The Irish Rebellion*; J. W. Good, *Ulster and Ireland*; R. M. Henry, *The Evolution of Sinn Fein*; P. W. Joyce, *Social History of Ancient Ireland*; M. Macdonagh, *The Home Rule Movement*; M. J. F. M'Carthy, *The Irish Revolution*; E. MacNeill, *Phases of Irish History*; J. Mitchel, *The History of Ireland*; Murphy, *Ireland: Industrial, Political, Social*; R. H. Murray, *Revolutionary Ireland and its Settlement*; G. O'Brien, *The Economic History of Ireland in the 18th Century*; Sir Horace Plunkett, *Ireland in the New Century*; P. Wilson, *The Beginnings of Modern Ireland.*

Language and Literature.—The Irish language belongs to the Gaelic or Gaedhelic branch of the Celtic stem of languages, being closely akin to the Gaelic of Scotland and the Manx, and more remotely allied to the British dialects (Welsh, Cornish, and Armoric). The modern dialects or varieties of Irish, which differ very much from the ancient, are spoken by the rural classes in Connaught and Munster, and parts of Ulster. In 1881 there were 64,000 people who spoke Irish only, and over 885,000 who could speak it along with English; in 1901 the numbers were 20,953 and 620,189. In 1893 the Gaelic League was founded, and has been steadily working to revive the Irish language. Gaelic is a comparatively modern form of Irish, which, both linguistically and from the extent and antiquity of its literature, is far more important than Gaelic.

Irish literature is rather varied and extensive, including history, legendary and actual, in prose and verse, annals, genealogies and pedigrees, mythological and imaginative tales, lyric poetry, satire, lives of saints, treatises on law, science, and grammar. Some of these may be as old as the fifth century of our era. One of the earliest historic pieces is a metrical *Life of St. Patrick.* Among the most important of the heroic tales is the *Táin Bó Cualnge* (Cattle Driving of Cualnge), the centre of a series of epic tales. A certain number of poems and tales, forming a cycle of their own, may be called Ossianic; most of them are comparatively modern. The glosses written to Latin works by Irish ecclesiastics, in the monasteries on the Continent founded during the seventh and eighth centuries, are among the oldest specimens of the language. Many bardic remains belong to the period of the English conquest, but after that date Irish poetry appears to have declined. Many bards, however, who were still maintained by the native chiefs, helped by their songs to keep up a national feeling hostile to the English domination. The native authorities for Irish history may go back to St. Patrick at the very earliest. The oldest list of kings dates from the middle of the eleventh century. The oldest and by far the ablest annalist, whose works have been at least partially preserved, is Tighernach O'Brian, who belonged to the royal family of the O'Connors of Connaught. He died in 1088. The other chief annals are the *Ulster Annals*, the *Annals of Innisfail*, and the *Annals of the Four Masters* (from its four different compilers). The most important Irish manuscripts are contained in the library of Trinity College, and in that of the Royal Irish Academy, Dublin, in the Bodleian Library, and the British Museum. In recent times a movement has been set on foot to restore the Irish language to general use and to revive Irish literature. Two societies have been very active in this revival: the Society for the Preservation of the Irish Language, and the Gaelic League.—BIBLIOGRAPHY: D. Hyde, *A Literary History of Ireland*; E. A. Boyd, *Ireland's Literary Renaissance*; *The Contemporary Drama of Ireland*; M. Maclean, *Literature of the Celts*; Justin M'Carthy (editor), *Irish Literature.*

Irenæ'us, Saint, Bishop of Lyons, a pupil of Polycarp, was born between A.D. 120 and 140, and was probably a native of Smyrna, He is generally supposed to have suffered martyrdom at Lyons, in the persecution under Septimius Severus in 202. He actively opposed the Gnostics. Only some fragments remain of his *Libri V adversus Haereses*, written in Greek. There is, however, a very ancient Latin version.

Irene (ī-rē'nē), Empress of Constantinople, was born at Athens about A.D. 752, and in 769 married Leo IV, after whose death she (780) became regent during the minority of her son Constantine VI. During the life of her husband she had been banished from the imperial palace for her devotion to the worship of images; but in A.D. 788 a council of bishops held at Nice under her auspices restored image-worship in the Eastern Church. When Constantine had grown up he took up the reins of government himself, and reigned for seven years, when his mother had him arrested and his eyes put out, and he was at last murdered. Irene was the first woman to reign over the Eastern Empire. She had ordered many nobles into banishment to secure her power more firmly, but Nicephorus, her treasurer, gained the imperial throne through their influence, and exiled her in 802 to the Isle of Lesbos, where she died in 803.

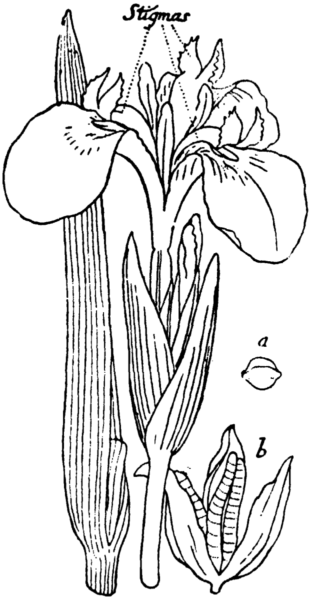
Ireton, Henry, a Parliamentary general, was born in Nottinghamshire in 1611, died in 1651. Descended from a good family, he was brought up to the law; but when the civil contests commenced he joined the Parliamentary army, and by the interest of Cromwell, whose daughter Bridget he married in 1646, he became commissary-general. He commanded the left wing at Naseby, which was defeated by the furious onset of Rupert, and himself made prisoner, but some hours later he recovered his liberty. He was an implacable enemy of the king, had a principal hand in framing the ordinance for his trial, and sat himself as one of the judges. Ireton accompanied Cromwell to Ireland in 1649, and was left by him as Lord-Deputy. He reduced the natives to obedience with great vigour, but cruelly. He died of the plague before the walls of Limerick, and was buried in Westminster Abbey (1652). After the Restoration, however, his remains were disinterred, hanged, and burned at Tyburn.

Iriarte'a, a genus of South American palms, tall-growing trees, of which one species, *I. exorrhiza*, the pashuiba or paxuiba palm, yields a hard kind of wood used for building, and exported for umbrella handles, &c.

Irida'ceæ, a natural order of endogenous plants, mostly herbaceous, and with equitant leaves (that is, leaves overlapping entirely in a parallel manner), three stamens with extrorse anthers, and an inferior ovary; natives chiefly of the middle parts of Europe and North America and the Cape Colony. They have beautiful flowers, and include the iris, gladiolus, crocus, ixia, &c.

Iridæ'a, a genus of Red Algæ, family Gigartinaceæ. *I. edulis* has a coarse obovate dark-red thallus, and is eaten like dulse.

Irid'ium (Gr. *iris*, rainbow) is a metal belonging to the platinum group; symbol, Ir; atomic weight, 193·1. Iridium is found in the form of grains, which consist essentially of an alloy of platinum and iridium, called platiniridium. Small grains of an alloy with osmium are also found, and known as osmiridium. Iridium is a white, lustrous, steel-like metal slightly heavier than platinum, its density being 22·4. It is hard and brittle when cold, but is rendered somewhat malleable at a bright red heat. It is fusible only at temperatures of the oxy-hydrogen blow-pipe flame. It is not acted upon by any acid, and differs from platinum in being insoluble in aqua regia. When alloyed with much platinum, or when in a finely-divided state, it dissolves in aqua regia. Iridium alloys with most metals, increasing their hardness, but it cannot be alloyed with gold. With platinum it forms alloys which are harder and stronger than pure platinum, and are much used in industry.



Yellow Flag or Corn Flag (*Iris pseudacŏrus*)

a, Seed. *b*, Capsule opening with seeds within.

Iridos′mine, or **Iridosmium**, a native compound of iridium and osmium, in which the iridium is less or more replaced by platinum, rhodium, and ruthenium. It is used for pointing gold pens, being nearly as hard as quartz, and iridium is obtained from it.

I′ris, in Greek mythology, the swift golden-winged messenger of the Olympian gods. Iris was originally the personification of the rainbow, though she does not appear as such in the Homeric poems. She is represented with wings attached to her shoulders and a herald's staff in her left hand, representative of her office of messenger. In Hesiod she is represented as the daughter of Thaumas and Electra, and sister of the Harpies. Alcæus and other writers say that she was the wife of Zephyrus and the mother of Eros.

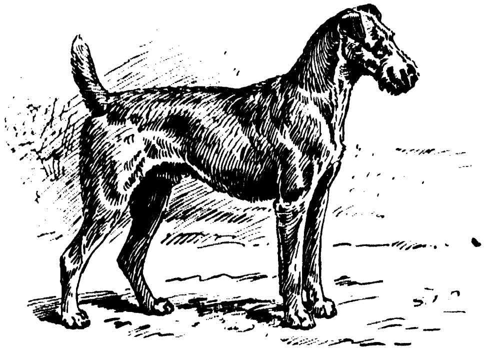
Iris, a plant that gives name to the nat. ord. Iridaceæ, and is also called flag and fleur-de-lis. The plants of the genus Iris, some of which are medicinal and others merely ornamental, are found in many localities over Europe, Asia, and America. They usually grow in wet places, bearing flowers of various colours, but the prevailing tint is blue. The common British species, *I. pseudacŏrus*, has yellow flowers. The stinking iris (*I. fœtidissima*) of Southern England has purple flowers and ill-smelling leaves. Orris-root consists of the root-stock of some species, as *I. florentina*; and the root-stock of this and other species are cathartic or emetic. Many beautiful species are grown in gardens, such as the Persian (*I. persica*), the snake's head (*I. tuberōsa*), the Chalcedonian, the Spanish, the English, the German, and the Japanese.

Irish Academy, Royal, a learned association in Dublin established in 1782, and incorporated in 1785. The Academy, governed by a council of twenty-one members, has been publishing important Irish MSS. which it has collected in its valuable library.

Irish Church, Language and Literature, &c. See *Ireland*.

Irish Sea, the sea between Great Britain and Ireland, north of St. George's Channel and south of the North Channel, 130 miles long and about 60 miles wide.

Irish Terrier, a breed of dog that has become very popular of recent years; an animal of medium size, rather strongly built and wiry, rough-coated of a yellowish or reddish colour, very intelligent and affectionate.



Irish Terrier

Iri′tis is inflammation of the iris of the eye. It is marked by pain in the orbit and forehead (usually worse at night), by redness and injection of the surrounding conjunctiva, and by contraction of the pupil. It may arise as the result of direct injury, or from the spread of inflammation of the surrounding parts of the eye (secondary iritis), or it may be due to some germ deposited from the blood stream in the iris and setting up the inflammation. When the condition is chronic the pain and injection are absent, but there is usually considerable discoloration, and there may be deposit of cells forming masses which appear on the back of the cornea as dots. Recurrent attacks lead to atrophy of the iris.

Atropine should be instilled into the eye to dilate the pupil as soon as possible, and in the early stages cocaine may be used with it to relieve the pain. Dry heat in some form should be applied over the eye, and if the pain be very severe, leeches should be applied to the temple. When the condition is due to some general constitutional disease, appropriate treatment for this disease should be carried out.

Irkutsk′, a town of Southern Siberia, capital of government of same name, at the junction of the Irkut with the Angara, about 40 miles from Lake Baikal. The town was founded by Cossacks in 1653. It has a cathedral and a number of public buildings, manufactures woollens, linens, and leather, and carries on a good trade in tea and other articles imported from China, and in furs. Pop. (1911), 108,000, including exiles.—The government, which is bounded by Yenisseisk, Yakutsk, Trans-Baikalia, Lake Baikal, and Chinese Turkestan, has an area of 280,429 sq. miles, and a pop of 821,800. Disturbances and riots took place at Irkutsk after the Russian Revolution of 1917, and especially after the Bolshevik *coup d'état*. Irkutsk was a place of exile for political offenders of Imperial Russia.

Irlam, an urban district or town in Lancashire, at the confluence of the Irwell and Mersey. In 1920 the boundary between Cheshire and Lancashire was altered, and parts of Carrington and Partington, in Cheshire, were made part of Irlam. Pop. 9471.

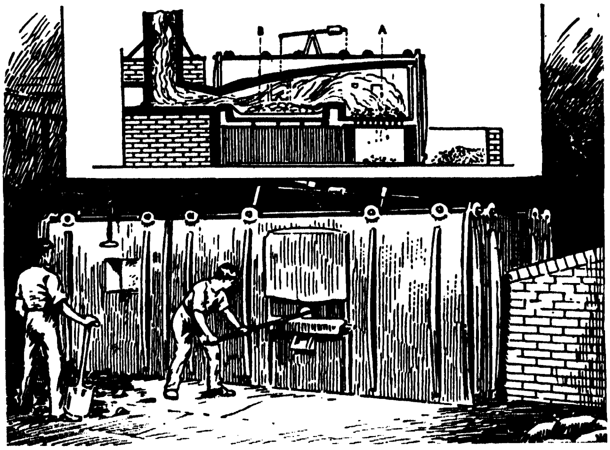
Iron, the commonest and best-known metal; symbol, Fe (Lat. *ferrum*); atomic weight, 55·84. It is so ductile that it can be drawn into wire as fine as the human hair, and two pieces can be perfectly welded together when raised to a white heat. It occurs in the earth's crust as compounds of iron in many minerals, and occasionally *native* or in the metallic state. There are two varieties of native iron, the *telluric* and the *meteoric*. The former occurs in small quantities only, in grains and thin plates, associated with lead and copper in rocks of volcanic origin. It is of a steel-grey colour. Meteoric iron is a pale steel-grey solid, very malleable and tough, flexible but not elastic. It has been found in masses in various parts of Europe, Africa, and America, and derives its name from having travelled through the air in the form of meteors, and having been brought to the earth from outside space by the attraction of gravity. All the specimens of meteoric iron analysed contain nickel, most of them also cobalt, besides copper, manganese, and other elements.

The commercial metal is obtained from ores of iron, and always contains small amounts of impurities, especially carbon and silicon, and usually sulphur and phosphorus. The ores are very numerous, but the oxides, carbonates, and sulphides are the most important, and, from the manufacturing point of view, the following are the most valuable: (1) *Magnetic Iron Ore*, Fe_3O_4. This, the richest of all the ores of iron, contains, when pure, 72·4 per cent of metallic iron. It is iron-black in colour, with a metallic lustre, highly magnetic (especially the specimens of it that are called *native loadstone*), and extremely infusible. Some mountains in Lapland and Chile consist almost entirely of this variety of ironstone. In Sweden it exists in great abundance and purity, and the bar-iron produced from it is much in demand by steel manufacturers. It is plentiful also in Norway, Russia, the East Indies, China, and the north-east part of the United States. Various parts of Great Britain also possess deposits of magnetic ore. Its specific gravity varies from 4·24 to 5·4. (2) *Hæmatite* or *Specular Iron Ore*, *Red Hæmatite*, Fe_2O_3, or ferric oxide. This mineral in its purest state contains about 70 per cent of iron. Specular ore is deep steel-grey in colour, with a brilliant, and often iridescent tarnish externally; its fracture exhibits a brilliant lustre. It is opaque in large fragments, but the edges of small thin scales are of a blood-red colour by transmitted light. This ore is found in the older rocks, especially gneiss and granite, both in beds and veins. Great Britain has rich deposits of hæmatite in Cumberland. France, Germany, Russia, and North and South America have large deposits of the crystalline variety. (3) *Brown Iron Ore*, *Brown Hæmatite*. This variety consists essentially of hydrated ferric oxide, and contains when pure about 60 per cent of iron, along with about 16 per cent of combined water. Brown iron ore occurs plentifully in France, Germany, Belgium, and in England, chiefly in the Forest of Dean, in Devonshire, Lincolnshire, and near Durham. Brown hæmatite is generally a yellow powder, sometimes passing into a brown or velvet black. Before the blow-pipe it blackens and magnetizes, but after calcination and cooling the powder becomes red, and in this state is much used for polishing metals. *Bog iron ore* is a variety of brown hæmatite which occurs in most European countries, and is so named from its being chiefly found in marshy places. (4) *Spathic Iron Ore*. This mineral, as the name implies, resembles rather an earthy than a metallic substance. It consists essentially of ferrous carbonate, $FeCO_3$, and when pure contains 48·2 per cent of iron. It occurs in the older rocks in veins and beds, among the chief deposits being those in Styria and Westphalia, the Pyrenees, Colombia, and Great Britain. Spathic ironstone is often associated with considerable quantities of clayey and coaly matter; when the former substance predominates, the ore is known as *argillaceous* or *clay ironstone*; when the coaly matter is in excess, the ore is called *carbonaceous* or *black-band ironstone*. These varieties occur in several of the coal-fields of Great Britain. The colour of the clayey carbonates of iron varies from reddish-brown through yellow-brown to dark brownish-black. (5) *Iron Pyrites*, FeS_2. This mineral, when pure, consists of 46·5 per cent of iron combined with 53·5 per cent of sulphur, and is the most widely distributed of all the ores of iron. It occurs in many forms disseminated in rocks, veins, and beds, and is frequently found in coal-seams. The United States have immense deposits of it. The ordinary colour is brass-yellow. Before the blowpipe it burns, giving out a sulphurous odour, and leaving a blackish residue, which is magnetic. This mineral is chiefly used as a source of sulphur in sulphuric acid factories, and the residues from the acid-works are now treated by a sintering process to reduce the amount of sulphur remaining, and to agglomerate the fine material into lumps suitable for the blast-furnace. In Siberia it is worked for the small percentage of gold it contains. The amount of iron ore raised in Britain is not now so great as formerly, and much is imported, especially from Spain.

Before certain ores, such as brown hæmatites, spathic iron ore, clay ironstone, and black-band iron ore pass into the smelter's hands they are subjected to the preliminary process of *calcination* or *roasting*. The object of this operation is to eliminate water, carbon dioxide, sulphur, and other volatile substances, to oxidize ferrous compounds to ferric, and at the same time to render the ore more porous. This is now generally effected by placing the ironstone over a coal-fire at the bottom of a kiln; when the ore is red-hot a fresh layer, 8 or 9 inches in depth and mixed with coal, is added, and so on until the kiln is filled. When the bottom layer is cold, it can be withdrawn, and the process thus becomes continuous. The old and wasteful method of calcining in the open air is now rarely used, except in the case of black-band ore.

The *smelting* of the iron is the next process, that is, the production of the metallic iron from the ore. The iron-smelter must carefully consider the nature of the ores to be treated, and the due admixture of different varieties; the most suitable fuel; the production and maintenance of a high and even temperature; and he must also select such materials, *fluxes*, usually limestone, to mix with the ores as shall form a fluid slag with the gangue and deleterious substances in the ore. This slag floats on the surface of the molten iron, and flows away automatically. As it cools it sets to a grey solid, and can then be broken up and used as roadmetal or for other useful purposes. The most advantageous combination of ores can be determined from chemical analyses. Until the beginning of the seventeenth century charcoal was exclusively used for iron-smelting, but coal and coke have now taken its place, except in those countries where forests still abound and charcoal can be procured readily and cheaply. Chief among iron-smelting appliances is the blast-furnace, and the great progress made in the production of pig-iron during the past thirty years is largely due to better-constructed furnaces. In all modern furnaces the waste gases of the furnace are utilized for raising heat and steam, with a consequent large saving in fuel, and the residual or by-products which were formerly lost are also collected, all tending to reduce cost of manufacture. (See *Blast-furnace*.) The molten iron, as it runs from the furnace, is generally conducted, along channels formed in strong binding sand, into moulds of the same material, in which it solidifies, forming what is known as *pigs*. For casting purposes the pig-iron is generally remelted in a special furnace, called a cupola furnace. This apparatus consists of a cylindrically-shaped furnace, varying from 10 to 15 feet high, and having an internal diameter of about 3½ feet. The furnace is composed of thick iron plates strongly riveted together, protected inwardly by a layer of binding sand about 9 inches thick, the whole being lined with fire-clay bricks. The molten iron run from the blast-furnace may also be cast directly. See *Casting*.

To obtain *malleable* or *wrought iron*, it is necessary to free the pig-iron from the sulphur, phosphorus, silicon, and excess of carbon it contains, as these substances render it unfit for rolling into bars or plates. A small quantity of carbon, varying from 0·1 to 0·2 per cent, generally remains in the wrought iron. The means by which the elimination of foreign materials from the iron are accomplished are partial oxidation of the iron, succeeded by the removal of the foreign substances in the form of oxides, partly as gases and partly by combination with the already oxidized iron in the form of slag. This is done by the process of *puddling*, which is carried on in a reverberatory furnace. In the ordinary puddling-furnace there is a hearth, on which the pig-iron is placed, and a grate separated from it, in which the fuel is placed. The bottom of the hearth consists of iron plates on which the working bottom proper is made up of oxidizing materials such as hammer scale, calcined tap cinder, the residue from pyrites burning, calcined iron ore, &c. The iron (about 4 cwt.) becomes heated by the hot gases that are allowed to play upon it, the shape of the furnace being designed to throw the heated gases down on to the surface of the molten mass on the hearth. In the furnace there is a suitable aperture through which the puddler thrusts his rake or *rabble*, and so stirs up the metal for some ten minutes, thus assisting in the process of oxidation. The silicon and manganese become oxidized and form a slag, and a violent action, known as *the boil*, then occurs; this is due to the formation of carbon monoxide by a reaction between the carbon in the iron and the oxide of iron on the hearth, which burns in jets at the surface. The whole mass then becomes pasty, and the phosphorus at this stage is oxidized, and passes into the slag. The metal is now worked into balls or *blooms* weighing each about 60 lb. When the whole of the metal has been collected into blooms, the door of the furnace is closed, and the temperature is raised to a full welding heat. The blooms are then carried to a powerful squeezer or to a steam-hammer. The melted slag is thus forced out of the ball, which is at the same time welded into a compact mass of metal, ready to go through the *rolling-mill*, which consists of two sets of grooved iron cylinders. The *roughing rolls* have Gothic and diamond-shaped grooves, roughened so as to grip the iron, and the *finishing-rolls* rectangular channels. These cylinders revolve in opposite directions, so that the metal in passing through them is powerfully compressed, whereby any slag remaining in it is squeezed out. The iron bars while still hot are cut into pieces by shears, which pieces are bound together by wire, and subjected to the operation of *re-heating* and *welding*. The bars are heated to a welding temperature, then again passed through the rolling-mill, whereby they are converted into a single bar. This bar may be again bent upon itself and again rolled, thereby producing what is known as *best bar* or *wire iron*. This iron is very tough and tenacious: it may be bent or even tied in a knot when cold without exhibiting the least sign of fracture. If iron breaks off when bent in a cold state, it is said to be *cold-short*; while if it stands this treatment, but becomes brittle at a high temperature so as to be unfitted for welding, it is called *red-* or *hot-short*. The presence of foreign elements influences these two properties of iron in a marked degree; thus a very small amount of sulphur, even such a quantity as ·05 per cent, causes bar-iron to become red-short. Bar-iron possesses a specific gravity varying from 7·3 to 7·9. The melting-point is estimated as being about 2700° F., that of cast iron 2000° F



Puddling Furnace (front view)

The small illustration above shows a section of the furnace.
A, Fuel. B, Pig-iron.

Iron is one of the metals which readily rust at the ordinary temperature, but only in the presence of moisture and carbon dioxide; the red product produced by the rusting is hydrated ferric oxide, and it dissolves readily in acids. The metal dissolves readily in nitric acid, evolving copious red fumes. Dilute sulphuric acid dissolves it readily and hydrogen is evolved, but usually contaminated with small amounts of other gas, and it thus has an obnoxious odour. The product formed in the solution is ferrous sulphate. If this is allowed to stand, *green vitriol* crystals, $FeSO_4, 7H_2O$, are deposited. The metal also dissolves in dilute hydrochloric acid, yielding hydrogen and ferrous chloride. When the metal is heated fairly strongly with concentrated sulphuric acid, it yields sulphur dioxide, SO_2.

In recent years ‘ malleable castings ’ have been introduced. The castings are made of white cast iron, and rendered malleable by the removal of the carbon. This is accomplished by embedding the castings in powdered red hæmatite in iron boxes, which are kept at a temperature of about 1650° F., or cherry-red heat, for a length of time varying from 12 to 72 hours, according to the type of casting treated. On cooling, the castings are found to consist of nearly pure iron, and to be fairly malleable, and therefore workable.

If iron is heated frequently or carelessly, it ceases to be fibrous and loses its tenacity; it is then said to be *burnt*. To restore it to its original condition, a fresh and very careful forging is generally needed.

It is not always easy to distinguish sharply between iron and steel, and many varieties of metal come into the market under the name of steel which in reality are alloys of iron with other metals, such as tungsten, manganese, chrome, &c. It is admitted by all metallurgists that one of the characteristics of true steel is that it hardens when heated and then suddenly cooled in water; but tungsten steel, for instance, hardens when cooled in air. Experienced workmen can distinguish iron from steel by the musical note emitted on striking. A more certain method consists in treating the metal with diluted nitric or sulphuric acid. If the surface remains unaltered, or nearly so, when touched with a drop of either acid, the metal is iron; in the case of steel a black mark will be left, owing to the liberation of carbon. If a small piece of the metal be highly polished on very fine emery-paper, and examined by a magnifying lens or low-power microscope, considerable quantities of slag will be visible in wrought iron, but not in steel.

Pure iron is a silver-white metal, with a high lustre, very tenacious, capable of receiving a high polish, and so soft as to be easily cut with a knife. It may be obtained by heating pure ferric oxide in a stream of hydrogen, or by electrolytic deposition, a method which has recently found important applications in technical work. In its chemical analogies iron is closely related to the metals cobalt, nickel, and chromium, and forms a large series of salts.

The principal iron manufacturing countries are the United States, Great Britain, Germany, France, and Belgium. The production of all classes of pig-iron for 1899 in Great Britain amounted to 9,420,000 tons, in 1907 to about 10,000,000, and in 1920 to 8,007,900, partly from ore imported. The production in the United States was about 25,781,000 tons in 1907, and 36,750,000 in 1920. For the manner in which iron is converted into steel, see *Steel*.

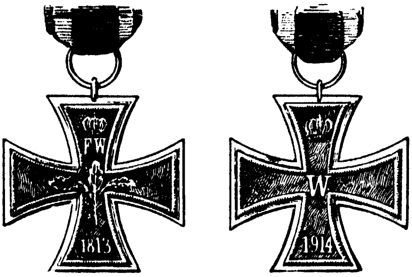
Besides its numerous other uses, iron is of great value medicinally, especially as a tonic and restorative of the blood. Hence it is very efficacious in anæmia and chlorosis, in rickets and scrofula, and in convalescence from various illnesses. In neuralgia it is often beneficial, and especially when given along with quinine. Some of its preparations have a styptic or astringent effect. It is given in many forms, as the carbonate, citrate, sulphate, perchloride, &c. Mineral waters often owe their useful properties to iron, being then known as chalybeate springs.—BIBLIOGRAPHY: W. Macfarlane, *The Principles and Practice of Iron and Steel Manufacture*; Thomas Turner, *The Metallurgy of Iron*; A. M'William and P. Longmuir, *General Foundry Practice*; O. F. Hudson and G. D. Bengough, *Iron and Steel*.

Iron Bacteria. The capacity for abstracting iron from the waters in which they live, and collecting it in the form of ferric hydroxide on their surfaces, is possessed by several kinds of micro-organisms that thrive in fresh water. Among these this peculiar physiological activity is possessed in the highest degree by certain of the organisms that are classed under the term bacteria. The best known are the following: *Leptothrix ochracea* (Kützing), *Gallionella ferruginea* (Ehrenberg), *Spirophyllum ferrugineum* (Ellis), *Crenothrix polyspora* (Cohn), *Cladothrix dichotoma* (Cohn), *Clonothrix fusca* (Schorler). All these belong to the higher bacteria, which differ from the lower bacteria, e.g. the bacillus, coccus or spirillum (*Schizomycetes*), in the possession of a thread-like or a band-like structure, and in somewhat more complicated methods of reproduction. At certain seasons of the year they are apt to multiply with extraordinary rapidity, and cases are known in which great anxiety has been caused by the rapid growth of iron bacteria in reservoirs and water conduits. Such a case occurred in 1896 in the reservoirs which supply Cheltenham with water: in less than a week the reservoir assumed the appearance of a dirty horsepond. Their rapid multiplication is almost always associated with waters which are alkaline in reaction, and which have their gathering-grounds wholly or partly from land of a peaty or boggy nature. A very slight organic content in the water supplies them with all the food which they require. During their growth the iron which is associated with the organic molecule is brought out of solution and precipitated in the substance of, or on the outer surface of, the wall of the organism. As a result the volume of the organism is increased two or threefold. After its death the organism sinks to the bottom of the water, and remains there as a rusty-red particle of almost pure ferric hydroxide. The beds of ferruginous streams are almost always made up of countless bodies of such organisms.

Iron Corps, the name applied to the 3rd Corps of the German army, which greatly distinguished itself in the Franco-Prussian War of 1870. The name was also applied to the first Siberian Corps of the Russian army during the European War.

Iron Cross, a German, originally a Prussian, military order, first instituted in 1813 by Frederick William III as a reward for services against

France. The badge is a cast-iron Maltese cross with a milled silver edge. The order was re-instituted in 1870 for all Germany. It has three grades, and is divided into military and civil divisions. For civilians the ribbon is white with two black stripes, for military recipients it is black with two white stripes. Nearly three million iron crosses were awarded in Germany during the European War.



Original Prussian Pattern

Pattern in use during the European War

Iron Cross. From examples in the Imperial War Museum. Actual size, 43 mm. square

Iron Crown, a golden crown set with precious stones, with which anciently the Kings of Italy, and afterwards the German Emperors, were crowned, when the latter assumed the character of Kings of Lombardy or Italy. It has received the above name from an iron circle in it, forged, according to tradition, from a nail of the cross of Christ. It was worn by Charlemagne, by Charles V, and by Napoleon I, who crowned himself with it at Milan in 1805. In 1866 it was given up by Austria to Victor Emmanuel on the conclusion of the peace. The crown, carried off by the Austrians in 1859, was restored in 1866 to Monza, where it is still preserved in the church of St. John the Baptist.

Iron Gates, a narrow part in the course of the Danube between Orsova and Turnu Severin, in South-West Roumania. It was formerly dangerous to shipping owing to rocks and rapids, the river being confined between steep precipices; but between 1890 and 1900 an artificial channel was made.

Iron Mask, The Man with the, an unknown personage kept in various French prisons, who for a long time excited much curiosity. All that is known of him is that he was above middle height, of a fine and noble figure, and delicate brownish skin; that he had a pleasant voice, was well educated, and fond of reading and guitar playing, and that he died in the Bastille in 1703. The mask he wore seems to have been of black velvet, not iron. Conjecture has given him many names. He was stated to be in turn the Count of Vermandois (a natural son of Louis XIV and de la Vallière), the Duke of Beaufort, the Duke of Monmouth, the son of Anne of Austria (mother of Louis XIV) by some favourite, and twin-brother of Louis XIV, but all these assertions have been unable to stand the test of thorough investigation. The last is made use of by Dumas père in *L'Homme au Masque de Fer*. What seems most probable is that he was Count Ercole Mattioli, first minister of the Duke of Mantua, who had betrayed the interests of Louis XIV by failing to secure for him, as he had pledged himself to do, in consideration of a large bribe, possession of the fortress of Casale, which gave access to the whole of Lombardy. For this offence the court of Versailles lured him to the French frontier, and secretly arrested and imprisoned him in the fortress of Pignerolo. The secret was preserved so carefully—on the supposition that Mattioli was the ill-fated prisoner—because his seizure and detention were flagrant violations of international law. Another theory is that the man with the iron mask was the person called Eustache Dauger, imprisoned in July, 1669.—Bibliography: M. Jung, *La vérité sur le masque de fer, 1664–1703*; F. Funck-Brentano, *Legends of the Bastille*; A. Lang, *The Valet's Tragedy*; T. Hopkins, *The Man in the Iron Mask*.

Ironton, a city of Ohio, United States, on the River Ohio, 140 miles above Cincinnati, the centre of an iron-producing district. Pop. 13,147.

Iron-wood, a name given to various trees from the quality of their timber. The iron-wood or hop-hornbeam of America (*Ostrya virginica*), nat. ord. Cupuliferæ, is a tree with a trunk not exceeding 6 inches in diameter, with very hard wood, so heavy that it sinks in water, and foliage resembling that of birch. Other trees thus named are species of Sideroxylon, Metrosideros, Mesua, and Inga.

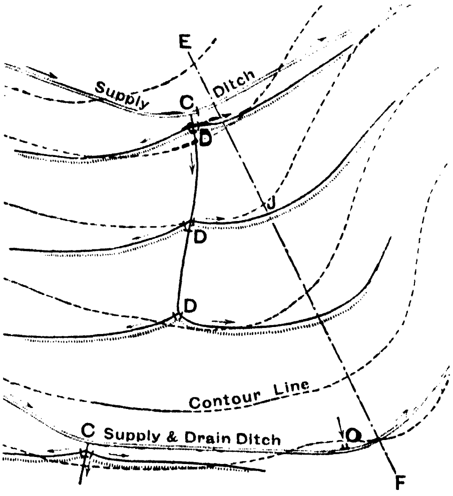
I′rony (Gr. *eirōneia*, dissimulation), a form of speech in which the meaning intended to be conveyed is contrary to the natural meaning of the words. Irony, as a rhetorical device, becomes a most effective weapon for ridiculing an antagonist. Some of the Athenian orators were great masters of this refined mode of derision. The *Œdipus Tyrannus* of Sophocles is a classic example of tragic irony—a form of irony in which there is a secondary meaning in the words of a speaker, unknown to the speaker himself, but obvious to the spectators.

Iroquois (i′ro-kwą), the joint name given by the French settlers in Canada to a once-powerful confederacy of five North American Indian tribes (Mohawks, Oneidas, Senecas, Cayugas, and Onondagas), to which was added after 1726 the Tuscaroras, thus making the famous Six Nations. They formerly resided on the Mohawk River, and extended their conquests to the Mississippi, and beyond the St. Lawrence. It is probable that but for the settlement of the whites they would have secured dominion from Canada to the Gulf of Mexico. Some of the tribes are now extinct; some have made considerable advances in civilization, while others have fallen into a state of squalid misery. Part of the Canadian Indians are Iroquois.—Cf. D. Cusick, *Sketches of Ancient History of the Six Nations.*

Irreden'tism (*irredenta*, unredeemed), a term applied in Italy to a movement created for the purpose of delivering Italy from foreign rule and dominion. The movement arose during the second half of the nineteenth century, after the formation of the Kingdom of Italy, and especially after the Berlin Congress of 1878. The Irredentists claimed all the territories which had an Italian-speaking population, such as the Trentino and Trieste from Austria, Malta from Great Britain, and Corsica from France. Irredentism ceased to be an influential factor at the beginning of this century, but at the outbreak of the European War the Irredentists became again very active. At the Paris Peace Conference their requests were conceded, as nearly all the districts then claimed by them, with the exception of Fiume (q.v.), were returned to Italy.

Irrigation, the art of increasing the productivity of soils by the artificial supply of water to them. This is as old as agriculture, and references to it exist in very early records, especially in Egypt, India, and China. Irrigation and land drainage are intimately associated, for were the soil kept flooded with water the end in view would not be attained. It is clear that water-supply is a controlling factor in the production of crops, for even when dry these contain more than 50 per cent of water, while in the fresh condition the percentage ranges from 75 to 90. It is also necessary to take into account the water which is evaporated or transpired from the leaves and stems, and all that is either evaporated or fails to be held by capillarity and percolates through the soil to the water-table. It has been calculated, for example, that the production of 1 ton of dry substance by the oat crop has been associated with the loss of over 500 tons of water in these three ways. Even in England, where the average annual rainfall is from 25 to 35 inches, it is necessary to husband the water in the soil, especially during dry seasons, by such cultural operations as harrowing, rolling, and hoeing; and in some parts of the country there are 'water' meadows which are irrigated by periodic flooding. In semi-arid regions with a rainfall of from 10 to 15 inches it is found possible to conserve the moisture of the soil by the methods of 'dry' farming, so as to secure a crop every other year, or two crops in three years. In such cases irrigation would be necessary for the production of an annual crop, and in areas with still smaller rainfall agriculture is only possible when irrigation is practised. A large part of Mesopotamia, for example, which is now desert was once rendered fertile in this way, and it would be possible to make it so again.

The character of the water supplied by irrigation is by no means a matter of indifference, for its value largely depends on the amount of plant-food it holds in solution. When this is high the manure bill is reduced, thus diminishing the cost of treatment. A good example is afforded by sewage-farms, where the main object is not to supply water but fertilizing ingredients.



Plan

Section EF.

Irrigation.—Flooding a steep slope by contour ridges (Grunsky). Water flows out of the supply ditch at C and is led down to be caught by the distributing furrows or ridges DDD.

In any system of irrigation it is of course necessary to bring water from a greater or less distance, and preferably from a higher level. Pumping operations become necessary when it is conveyed from a lower level, and the cost of these are often prohibitive. In all cases the surface inequalities must be removed by some kind of levelling, for otherwise it would be impossible to secure even distribution of water.

There are two chief methods of irrigation: (1) flooding, (2) furrow irrigation. *Flooding.* Here the whole surface is covered with water, either by allowing a thin layer to run over it continuously, or by supplying all that is required by means of a single operation. In the former procedure water is liberated from a distributing furrow, and in the case of a well-marked slope there is a series of such furrows. In water-meadows there is a supply ditch running along the top of the slope, and from this the water flows down a series of distributing furrows placed on ridges, overflowing from these to submerge the ground, and draining below into a second ditch. The alternative method of flooding is much used on fairly level ground, especially in the case of closely growing crops, such as rice, lucerne, and clover. Here the water passes from a canal or other source of supply into a system of ditches, which gradually overflow until the ground is submerged to the extent desired. *Furrow irrigation* is applicable to all sorts of crops, including fruit-trees, which are grown in rows. The rows must follow the slope of the ground, and the furrows are cut out between them.

Irrigation is largely practised in South Europe, Algeria, Egypt, India, Australia, and the United States. It has played an important part in the development of the British Empire, a recent example being afforded by the irrigated lands that are being financed by Victoria and New South Wales jointly.—BIBLIOGRAPHY: J. Scott, *Irrigation and Water Supply*; King, *Irrigation and Drainage*; F. H. Newell, *Irrigation Management*; A. P. Davis and H. M. Wilson, *Irrigation Engineering.*

Irritability in Plants, the property of reacting by movements, &c., to external agencies, of which the most important are gravity, light, contact, temperature, water, oxygen, and many other chemical substances; these agencies are termed *stimuli*, and the resulting reaction is called a *response*. All living organs are more or less irritable, but some responses are more striking than others, notably the quick movements induced by contact in the case of irritable stamens (barberry, Sparmannia) and stigmas (Mimulus), the sensitive plants (Mimosa, &c.), some insectivorous plants (Dionæa), and so forth. See *Chemotropism*; *Geotropism*; *Haptotropism*; *Heliotropism.*—BIBLIOGRAPHY: Charles Darwin, *Power of Movement in Plants*; L. Jost, *Lectures on the Physiology of Plants.*

Ir′tysh, a large river of Northern Asia, rises in the Altai Mountains in Chinese territory, forms Lake Zaisan, then flows N.N.W. through Asiatic Russia, and after a course of 1800 miles falls into the Obi. It receives the waters of several important rivers, and has important sturgeon fisheries.

Irún (ē-rṳn′), a town in the north-east of Spain, province of Guipúzcoa, near the Bidassoa and the French frontier, 8 miles east of San Sebastian. There are thermal springs in the vicinity. Pop. 10,000.

Ir′vine, a royal and municipal burgh and seaport of Scotland, in Ayrshire, on the Irvine, 24 miles south-west of Glasgow. It has a good harbour, and there are chemical-works (for explosives, &c.), engineering-, foundry-, and shipbuilding-works. Pop. (1921), 11,826.

Irving, Edward, the founder of the sect called Irvingites, was born Aug., 1792, at Annan, Dumfriesshire, died at Glasgow, Dec., 1834. After a good education at Annan he went in 1805 to the University of Edinburgh, and, having entered the ministry of the Established Church, he was appointed in 1819 assistant to the celebrated Dr. Chalmers in Glasgow. In 1822 he became minister of the Caledonian Asylum Chapel, a Presbyterian place of worship in London. His impressive eloquence, combined with singularity of appearance, and his mannerisms, soon brought him into notice, and for a time the great as well as the fashionable flocked to hear him. In 1823 he published a work called *For the Oracles of God, Four Orations*, which sold extensively. About two years later he wrote an *Introductory Essay to Bishop Horne's Commentary on the Book of Psalms*, considered one of the best products of his pen. His theological peculiarities were well set forth in a collection of *Sermons, Lectures, and Occasional Discourses* (3 vols.), issued at London in 1828. These attracted much attention, and brought him shortly afterwards into conflict with the Presbytery, with the result that in 1832 he was dispossessed of his living in London, and in 1833 the presbytery of Annan, which had licensed him, deposed him from the ministry. He was charged with holding Christ guilty of original and actual sin, and denying the doctrines of atonement, satisfaction, imputation, and substitution. He was a believer in the speedy coming of Christ, and held that miraculous gifts of apostolic times had not ceased to be bestowed on the Christian Church. See *Irvingites.* —BIBLIOGRAPHY: Mrs. F. W. Oliphant, *Life of Edward Irving*; E. Miller, *History and Doctrine of Irvingism.*

Irving, Sir Henry (originally John Henry Brodribb), an English actor, born 6th Feb., 1838, died 13th Oct., 1905. He was for a time a clerk in London, but adopted the theatrical profession, his first appearance being at Sunderland in 1856. After playing for nearly three years in Edinburgh he appeared at the Princess's Theatre, London, in 1859. After a short stay here, and a few months in Glasgow, he went to Manchester, where he remained for five or six years. Having returned to London in 1866, he took part in the *Belle's Stratagem*, *Hunted Down*, and *Uncle Dick's Darling*; but his first marked success was as Digby Grant in Albery's *Two Roses* (in 1870), which was followed by his powerful impersonation of Mathias in *The Bells* (founded on Erckmann-

Chatrian's *Le Juif Polonais*). His next noteworthy parts were Charles I, Eugene Aram, and Richelieu, in the plays so named. In 1874, at the Lyceum Theatre, he sustained the part of Hamlet so successfully as to raise himself to the first place among English actors. His chief Shakespearian parts subsequently played are Macbeth, Othello, and Richard III. In 1878 he leased the Lyceum Theatre for himself, and then put upon the stage in excellent style *Othello*, *The Merchant of Venice*, *Much Ado About Nothing*, *Romeo and Juliet*, *Twelfth Night*, *Faust*, *Macbeth*, &c., playing in them the principal character along with Miss Ellen Terry. His appearances in the provinces were as successful as those in London, and he met with equal favour in his visits to the United States. He contributed papers to the magazines on subjects connected with his art, and delivered addresses at Oxford and Harvard Universities. He was knighted in 1895.—BIBLIOGRAPHY: W. Archer, *Henry Irving, Actor and Manager*; A. Brereton, *The Life of Henry Irving*; B. Stoker, *Personal Reminiscences of Henry Irving*.

Irving, Henry Brodribb, British actor-manager and author, eldest son of Sir Henry Irving, born in London, 5th Aug., 1870, died 17th Oct., 1919. Educated at Marlborough College and New College, Oxford, he was called to the Bar in 1894. He soon, however, gave up law and followed in his father's footsteps. In 1891 he had already appeared in Sir John Hare's company, and in 1894 he was with Comyns Carr at the Comedy Theatre. From 1896 to 1900 he acted with George Alexander at the St. James's Theatre. Among the characters which Irving impersonated were the title-rôle in Sir J. M. Barrie's *The Admirable Crichton* and Hamlet. He was also successful in *The Lyons Mail* and *Dr. Jekyll and Mr. Hyde*. His works include: *French Criminals of the 19th Century*, *The Trial of Mrs. Maybrick*, and *The Life of Judge Jeffreys*.

Irving, Washington, American man of letters, born in New York 3rd April, 1783, died 28th Nov., 1859, at Sunnyside, on the Hudson. He was the son of a Scotsman who had emigrated to New York before the Revolution, and had become a merchant of some standing. Although educated for the legal profession, his tastes were in the direction of literature, and already in 1802 his *Letters of Jonathan Oldstyle* appeared in the *New York Morning Chronicle*. Shortly afterwards, being threatened with pulmonary disease, he sailed for Europe, visited most Continental countries, and did not return to America until March, 1806. In the same year he was called to the New York Bar. His pen was now very busy, and his sketches of Dutch character, in his *Knickerbocker's History of New York*, which made its appearance in December, 1809, proved him possessed of quaint and genial humour to a high degree. About this time he joined his two brothers as a sleeping partner in a mercantile venture, and in 1815 he visited England. The failure of his brothers' business made him resolve to follow literature as a profession, and he settled in London. A series of papers which he now wrote, entitled *The Sketch-book*, first published at New York, 1818, met with such success that an enlarged edition was published in London two years later. For seventeen years until 1832 Irving resided in Europe, principally in England, France, and Spain. This was a period of great literary activity, and brought forth some of his most famous works, such as *Bracebridge Hall*, *The Tales of a Traveller*, and *The Life of Columbus*, for which 1000, 1500, and 3000 guineas respectively were paid him by the publishers. He also acted for a time as secretary to the American Embassy in London, and the University of Oxford honoured him in 1831 with the degree of D.C.L. Having returned to New York in the spring of 1832, he accompanied the expedition for the removal of the Indian tribes beyond the Mississippi, and collected the material for his *Tour on the Prairies*, published in 1835. From 1842 to 1846 he acted as United States Ambassador at Madrid, and on his return in that year he retired to his country seat at Sunnyside. His *Life of Oliver Goldsmith* (1849), *Mohammed and his Successors*, and the *Life of Washington* (1855–6) occupied his last years. Other works of his are: *The Conquest of Granada*, *Tales of the Alhambra*, *Legends of the Conquest of Spain*, *Voyages of the Companions of Columbus*, *Adventures of Captain Bonneville*, and *Astoria*. His famous story of *Rip van Winkle* belongs to the *Sketch-book*.—BIBLIOGRAPHY: P. M. Irving, *Life and Letters of Washington Irving*; W. C. Bryant, *Discourse on the Life, Character, and Genius of Washington Irving*.

Irvingites, a name given to believers in, and followers of, Edward Irving, forming a sect properly designated as the Catholic Apostolic Church. They have some churches in the United Kingdom, and a few unimportant congregations exist also in Germany, France, Switzerland, Canada, and the United States. They are supposed to number about 5000 adherents in Great Britain, and about 20,000 in Germany and Switzerland. Their chief distinguishing feature is the belief in a revival of the spiritual gifts of the first ages of the Church, such as speaking in 'unknown tongues', and prophesying. In their Constitution, which they claim to be a development of the primitive Church, they adopted the fourfold ministry of apostles, prophets, evangelists, and pastors and teachers (*Eph.* iv, 11). Two years after Irving's death the number of apostles had been completed to twelve. They recognize all Christian communities, and embody in their ritual portions of those used in different sections of the Church, including the Roman and Greek Catholic. The ministry is supported by tithes. The members expect the second coming of Christ to take place soon.—Cf. E. Miller, *History and Doctrine of Irvingism.*

Isaac (Heb. *Yishāk*, he will laugh, from *sāhak*, to laugh), one of the Hebrew patriarchs, the son of Abraham by Sarah, so called to denote the *laughter* and *gladness* occasioned by his birth. He is remarkable for his miraculous escape from death as a burnt-offering; and for the fraud perpetrated upon him, at his wife Rebecca's instigation, by his son Jacob, to the injury of Esau. He died at Hebron when 180 years old, and was buried in the cave of Machpelah, the resting-place of Sarah and Abraham, and of Rebecca.

Isaac I, *Comnenus*, Emperor of Constantinople, raised to the throne in 1057. He brought about great reforms in the administration of the empire, and repelled an inroad of the Hungarians, but abdicated in favour of Constantine Ducas in 1059, and retired to a convent, where he died in 1061.

Isabella of Castile, daughter of King John II of Castile and Leon, consort of Ferdinand the Catholic, was born 1451, married 1469, and died 1504. She was a woman of great charms, courage, and sagacity, and contributed no small share to the many remarkable events of the reign of Ferdinand V, including the introduction of the Inquisition (1480), the discovery of America by Columbus (1492), and the final expulsion of the Moors after the conquest of Granada.—Cf. M. Hume, *Queens of Old Spain.*

Isabella II, ex-Queen of Spain, daughter of Ferdinand III, was born in 1830, died in 1904. She succeeded her father in 1833, her mother being appointed queen-regent. The early years of her reign were disturbed by a rising in favour of her uncle, Don Carlos, who, if the Salic law had not been set aside, would have ascended the throne instead of her; but this was finally quelled in 1839. She was declared of age in 1843, and in 1846 was married to her cousin, Don Francisco d'Assisi. Her reign was so despotic that a revolution took place in 1868, which drove her from the country. She resigned her claims to the crown in favour of her son Alfonso XII, who ascended the throne in 1875. After 1871 she lived sometimes in Spain, sometimes in Paris, where she died.—Cf. E. B. D'Auvergne, *A Queen at Bay.*

Isæ'us, an Athenian orator, who lived between 420 and 348 B.C. He was a pupil of Lysias and Isocrates, and, like them, became a teacher of rhetoric and writer of orations, chiefly judicial. Eleven of his orations are extant. His style is clear, forcible, and concise. He was a skilful forensic pleader, and a master of logical reasoning. His speeches almost all belonged to the law-courts; he seldom spoke on public questions. He was celebrated for his flow of language.

Isaiah, the son of Amoz, in some respects the greatest of the Hebrew prophets, lived during the second half of the eighth century B.C. Little is known about his personal history, but, from some allusions in his writings, we learn that he was a man of some social standing in Jerusalem, with a wife and at least two sons. He was not a priest. But his first vision of God came to him in the temple, about 740 B.C., "the year the King Uzziah died". He felt driven, at this crisis, to undertake the rôle of warning his nation against its moral carelessness and its political infatuation. From this it may be inferred that he was born about 760 B.C. He appears to have been an active figure in Jerusalem for about forty years, and the main episodes of his career fall within three periods, (*a*) 740–722, (*b*) 722–705, (*c*) 704–701.

(*a*) During the reigning of Ahaz (735–728) he comes forward (chapters ii–v) as a trenchant critic of the social and religious deterioration which accompanied Judah's material prosperity (vi–viii). The reformer indignantly declares that God will punish the nation for its luxury, its indifference to the poor, its formal religion, and its toleration of crime. But his threats include the promise that a surviving remnant will become the nucleus of God's true people. Later on, after the Assyrians had saved Judah by invading Israel, which had attacked her, Isaiah reiterates his warnings, which were clinched by the final Assyrian victory over Samaria in 722, when the northern kingdom came to an end.

(*b*) Isaiah's advice, as a statesman, was always to avoid any alliance with Egypt on the south, or the Assyrians on the north and east. Non-intervention was his counsel. He was convinced that Judah's best policy was to keep clear of any interference or alliance with either of these great powers. As indeed it was, although the opposition evidently dubbed this a pusillanimous attitude, and worked for some open alliance. Isaiah's stern conviction is that Egypt is a broken reed, and that the Assyrians, instead of proving sure allies of these imperialistic Jews, will be God's instrument in punishing a nation like Judah which is ethically and economically ruining itself.

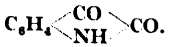
(*c*) Meantime, internal troubles in the Eastern realm gave a respite to Judah. But, when Sennacherib succeeded Sargon in 705, the end seemed to be near. In 702 he marched over into Palestine, prepared to crush Judah and the other states which had been tampering with rebellion. Isaiah suddenly believes that Jerusalem will be spared; he encourages King Hezekiah and the authorities to hold out, since God will not allow His sacred city to be demolished by the haughty Assyrians. Even at the darkest hour, when the Assyrians seem to have the city in their grip, the prophet never loses hope. He puts heart and faith into the panic-stricken leaders and citizens, and his foresight is vindicated. Sennacherib unexpectedly raises the siege. The predictions of Isaiah are brilliantly verified, and by the end of 701 the Assyrian retreat left Judah inviolate. The main passages relating to this supreme crisis are to be found in i, x, xxviii–xxix, xxx–xxxi, xxxiii, xxxvi–xxxvii.

It may be in the glow of relief after this deliverance that Isaiah penned his vision of the ideal kingdom and king, which is preserved in xxxii, 1–5, 15–20; ix, 2–7; xi, 1–8. But Isaiah disappears at this point. When Manasseh succeeded Hezekiah, in 697, a pagan reaction broke out in Judah, and Jewish legend made Isaiah one of the martyrs in the persecution; he was alleged to have been sawn asunder with a wooden saw. Possibly he did perish during Manasseh's reign. But the end of his life, like its beginning, is quite obscure. He lives by the record of his career during the last forty years of the eighth century.

When his prophecies were collected afterwards, they were supplemented by others from various hands, e.g. xxiv – xxvii, xxxiv – xxxv, and by a series of post-exilic prophecies which in the canonical book of *Isaiah* fill xl–lxvi. His extant, authentic writings are enough, however, to prove his poetical genius, his indomitable faith in God as overruling history for moral ends, his political insight, and his impressive personality. "In his writings there is felt and mirrored every phase of the complex life of that city and people, whose soul was to him nearer and dearer than his own, and all without one trace of self-consciousness!" (W. A. C. Allen, *Old Testament Prophets*, pp. 141, 142).—BIBLIOGRAPHY: Sir G. A. Smith, *Isaiah, I-XXXIX* (*Expositor's Bible*); S. R. Driver, *Isaiah: his Life and Times*; W. R. Smith, *The Prophets of Israel*; M. G. Glazebrook, *Studies in the Book of Isaiah*; G. B. Gray, *Isaiah, I-XXXIX* (*International Critical Commentary*).

Isar (ē'zär), a European river which rises in Tyrol, about 6 miles north-east of Innsbruck, enters Bavaria, flows past Munich, and joins the Danube; course about 180 miles.

Isatin, $C_8H_5O_2N$, an orange-coloured crystalline substance of melting-point 201° C., first obtained by oxidizing indigo with nitric acid or chromic acid. It is closely allied to indigotin, the colouring matter of indigo blue. Isatin played an important part in the researches which led to the synthesis of indigo from coal-tar products. It is the anhydride of *o*-aminophenylglyoxylic acid, and has the constitutional formula



$$C_6H_4{<}\begin{matrix}CO\\NH\end{matrix}{>}CO.$$

It forms, with thiophene, a blue colouring matter indophenin ($C_{12}H_7NOS$), when added to a solution of thiophene in concentrated sulphuric acid. The characteristic colour produced serves to detect thiophene in benzene, in which it is a common impurity.

Isau'ria, in ancient geography, a country in Asia Minor, bordering on Lycaonia, Phyrgia, Pisidia, Cilicia, and Pamphylia. Its capital, Isaura, was destroyed by the Romans.

Ischia (is'ki-ä), an island of Italy, 26 square miles in extent, in the Gulf of Naples, with beautiful scenery and a fertile soil, producing excellent wine and fruits. It is entirely volcanic in character, and is noted for its warm mineral springs and volcanic convulsions. In 1881 and 1883 earthquakes caused great loss of life and property. Several shocks have been experienced since, but without disastrous results. The capital, Ischia, with some 7000 inhabitants, is a favourite resort of tourists in Italy. Other towns are Casamicciola and Forio, both of which suffered severely in 1883. Pop. 28,000.

Ischl (ē'shl), a fashionable watering-place in Upper Austria, on the Traun, 50 miles s.w. of Linz, celebrated for its salt baths. The former Austrian Emperor had a residence in the neighbourhood. Pop. (district), 28,611.

Iseo (ē-sä'ō), or **Sabino**, a picturesque lake in Upper Italy, between Brescia and Bergamo, and formed by the waters of the Oglio; length, 15 miles; average breadth, 6 miles.

Isère (ē-sär), a river which rises in Italy, crosses Savoy, enters France by the department of Isère, to which it gives its name, and joins the Rhône 5 miles above Valence; length, about 190 miles, of which nearly 90 miles are navigable.

Isère, a department of South-Eastern France; area, 3178 sq. miles. It is generally mountainous, the highest summit being Le Grand Pelvoux, 13,158 feet. The whole department belongs to the basin of the Rhône, which drains great part of it directly, the only other important river being the Isère. The soil is generally fertile, and produces abundant cereal and leguminous crops, the vine and mulberry being also cultivated. Lead, copper, and iron are found in considerable quantities; also coal, marble, slate, granite, and porphyry, and the iron-mines employ a number of blast-furnaces. There are numerous paper-, silk-, and cotton-mills. Grenoble is the capital. Pop. 525,522.

Iserlohn (ē'zĕr-lōn), a town of Germany, in Westphalia, with manufactures in brass, bronze, tin, and iron, cutlery, zinc and iron furnaces, &c. Pop. 31,294.

Ishmael (Heb. *Yishmael*, whom God hears), the son of Abraham by Hagar. He married an Egyptian wife, and had twelve sons and one daughter, who became the wife of Esau. He died when 137 years old. It was predicted that he was to become 'a great nation', and the Arabs, especially the Bedouins, are often regarded as descendants of Ishmael.

Ishmaelites, Ismaelites, or **Ismaelians,** a Mahommedan sect originating in the first century of the Hegira, and deriving its name from Ishmael or Ismael, one of Ali's descendants. From the eighth to the twelfth century they were powerful in the East, made many conquests, and under various chiefs and names distributed themselves over Irak, Syria, Persia, and Egypt. A small remnant of them still dwell in Syria. The Assassins (q.v.) were a branch of this sect.

I'sidore, the name of three Spanish ecclesiastics, of whom the most famous was Isidore of Seville, who flourished at the beginning of the seventh century. He was the most profound scholar, the most eloquent orator, and the ablest prelate of his age and country, and consequently exercised a powerful influence over the development of Latin Christianity. He was made Bishop of Seville in A.D. 600 or 601, presided over the Councils of Seville, 619, and Toledo, 633; and died at Seville, 636. Several of his works, which embrace divinity, history, and philosophy, were translated into English as early as the middle of the sixteenth century. His *Etymologies* were edited by W. M. Lindsay in 1912.

I'singlass, a variety of gelatine prepared from the swimming-bladder or sound of the sturgeon, dried and cut into fine shreds. The American article is obtained from the same part of the cod and hake. It forms the basis of Russian glue, which is a very strong adhesive. Isinglass is largely used in cooking for the preparation of nutritious jellies, for clarifying sherries and other white wines, for making mock pearls, and for stiffening linens, silks, and gauzes, or thickening milk. The adhesive material of court plaster consists of isinglass mixed with a small proportion of some balsam. By means of a solution of isinglass in water, tannic acid may be distinguished and separated from gallic acid, the former giving a yellowish-white flocculent precipitate.

I'sis, the principal goddess of the Egyptians, the daughter of Seb (Earth) and Nut (Heaven), and the sister and wife of Osiris, representing the moon, as Osiris did the sun. She became the mother of Horus, the sun-god, also called Horus the Child, and distinguished from Horus the Elder, a son of Seb and Nut, and, therefore, a brother of Isis. The Egyptians believed that Isis first taught them agriculture, and as the Greeks offered the first ears gathered to Ceres, so did the Egyptians to Isis. She is represented under various forms. In one representation she has the form of a woman, with the horns of a cow, as the cow was sacred to her. She is also known by the attributes of the *lotus* on her head, and the *sistrum* in her hand, a musical instrument which the Egyptians used in the worship of the gods. She is often accompanied by her infant son Horus. In one celebrated Egyptian statue she was shown with her face veiled. She was particularly worshipped in Memphis, but at a later period throughout all Egypt. From Egypt her worship passed over to Greece and Rome, and the abuses which it occasioned at Rome caused its frequent prohibition there. It was, however, repeatedly revived. The Romans never considered the worship, which was introduced among them by Sulla (86 B.C.), altogether reputable, and its attendant immorality was vigorously lashed in the satire of Juvenal. Under the empire the cult of Isis became very popular, and among the priests of the goddess were Domitian, Commodus, and Caracalla.—Cf. Sir E. A. W. Budge, *Egyptian Religion.*

Isis, a kind of coral, popularly known as *Mare's-tail* coral, from its likeness to the plant of that name (Hippūris). It is found chiefly in the Indian Seas, in the Pacific Ocean, and on the coasts of America.

Isla, José Francisco de, born at Segovia 1714, died at Bologna 1783, a Spanish satirist after the model of Cervantes. His fame rests principally upon his *History of Friar Gerundio,* a satire on the monks of his time, a book which fell under the ban of the Inquisition. He translated *Gil Blas* into Spanish, and in his introduction to it by way of a jest propounded the theory that Le Sage stole his famous rogue-novel from Spain. This jest was taken seriously by several wiseacres, and the echoes of the controversy thus aroused have not yet died down.

Islam (is-läm'), the name given in the *Koran* to the religion founded by Mahomet. It is the infinitive form of *aslama,* to resign oneself, or to profess Islam. It does not imply, as it is often supposed, complete resignation and submission to the will of God, but means striving after righteousness. The fundamental doctrine of Islam, and the only one it is necessary to profess, to be a Moslem, is expressed in the common formula of faith: "There is no God but God, and Mahomet is his prophet", to which the Shiahs or Shiites, that is, the majority of Persian and Indian Moslems, add "and Ali is the vicar of God". Islam embraces all four sects now found among the followers of Mahomet. See *Mahommedanism.*—Cf. F. A. Klein, *The Religion of Islam.*

Island, in physical geography, a piece of land surrounded by water, but islands are of all types and of all sizes, from mere dots of land or rock in the sea, probably due to the submergence of mountains whose summits they represent, to a great mass like Australia, which is regarded as a continent. Islands are divided into two distinct classes: *continental* islands, lying in proximity to continents, and *pelagic* or *oceanic*, from their position in the oceans. Continental islands occur along the margin of the continents, and are generally of the same geological structure. Pelagic islands are mostly of volcanic or coral formation. A cluster of islands, such as the West Indies, the Canaries, or the Hebrides, is called an *archipelago.*

Islay (ī′lā), an island of Scotland, one of the Inner Hebrides, forming part of Argyllshire, and separated by the Sound of Islay from the Island of Jura. It is 25 miles long by 19 miles broad; area, 220 sq. miles. The coast is mostly bold and rocky, and the north and east of the island are hilly. There are extensive fertile tracts under tillage, producing good crops of grain, turnips, and potatoes. Cattle, sheep, horses, cheese, butter, and other agricultural produce are exported, as also large quantities of whisky, distilled in the island and sent chiefly to Glasgow. Pop. (1921), 6496.

Isles, Lord of the, one of the titles of the Prince of Wales, but formerly borne by the chieftains and rulers of the Western Isles of Scotland. The Lords of the Isles traced their descent from Somerled, who appears in Scottish history in the middle of the twelfth century, during the reigns of David I and his grandson Malcolm IV. Angus of the Isles gave his fealty to Bruce. One of the most powerful of the Lords of the Isles was Donald, who died about 1420. The last regular lord was John, who forfeited his title in 1493.—Cf. A. Lang, *History of Scotland.*

Is′lington, a municipal and parliamentary borough in the north of London. The parliamentary borough returns four members. Pop. (1921), 330,028.

Ismail (is′mȧ-il), or **Ismailia,** a town of Roumania, in Bessarabia, on the north arm of the Danube, 35 miles E. of the Roumanian port Galatz, and about 40 miles from the embouchure of the Danube in the Black Sea. It was destroyed by Suwarrov in 1790, and since then has been alternately governed by Turkey and Russia, ultimately falling under the dominion of the latter by the Treaty of Berlin in 1878. Under Roumania it has made rapid strides, both architecturally and commercially, and is now an important market for wool, hides and leather, corn, and tallow. Pop. 32,400.

Ismailia (is-mȧ-ē′lē-ȧ), a town of Egypt, on the salt lake Timsah, on the route of the Suez Canal, near where the freshwater canal from the Nile forks, one branch going to Suez, another to Port Said. It arose during the making of the Suez Canal, and was the head-quarters of Sir Archibald Murray during the European War (in 1916). Pop. 10,000.

Ismid, or **Izmid,** a town of Asia Minor, on the Sea of Marmora, seat of a Greek metropolitan and an Armenian archbishop. It represents the ancient *Nicomedia.* Pop. *c.* 20,000.

Isoc′rates, an ancient Greek orator, born at Athens 436 B.C. He spoke seldom in public; but he prepared orations for others, and trained many able orators, among his pupils being Isæus, Hyperides, and Lycurgus. His patriotism was sincere, and his desire for the freedom of Greece so intense that he starved himself to death in his ninety-eighth year from grief at the unhappy battle of Cheronæa. He was master of a graceful literary prose style, but was accused of being too florid and elaborate. Twenty-one of his orations are still extant.—Cf. Sir R. C. Jebb, *Attic Orators.*

Isoëtes, a genus of Lycopods, including some fifty temperate and tropical aquatic herbs, with a short tuberous stem and a tuft of awl-shaped leaves (hence the popular name quill-wort). They are heterosporous, the bulky sporangia being embedded singly in the bases of the leaves.

Isogamous Plants, those in which the male and female gametes are alike. Opposed to heterogamous plants.

Isom′erism (Gr. *isos*, equal, *meros*, a part), a chemical term first used by Berzelius in 1831. Substances which have the same percentage composition and the same molecular formulæ are now regarded as *isomeric*, e.g. ethyl alcohol and dimethyl ether, which differ considerably in chemical and physical properties, have the same formula, C_2H_6O. The isomerism is supposed to be due to different grouping of the atoms within each molecule.

Isomorph′ism (Gr. *isos*, equal, *morphē*, form) is the name given to the phenomenon of substances with analogous chemical formulæ crystallizing in crystals of exactly the same shape. It was formerly supposed that every substance had its own peculiar crystalline form. Mitscherlich, however, showed that certain elements or groups of elements may replace one another without altering the crystalline form of the compound. Thus the alums are isomorphous, and crystallize in well-defined octahedra; and a crystal of potash alum, if immersed in a concentrated solution of ferric alum, will grow in the solution, the successive layers being layers of ferric alum instead of potash alum. Iron has replaced potassium in the compound without altering the crystalline form.

Isonzo, a river in Italy, formerly in Austria, rising in the Julian Alps and falling into the

Gulf of Trieste. The towns of Gorizia, Plezzo, and Tolmino lie on its banks. During the European War fierce fighting took place between the Italians and the Austrians on the banks of the Isonzo. Several battles were fought during 1915, 1916, and 1917, the fighting in the district ceasing in May, 1917.

Isop′oda (Gr. *isos*, equal; *pous*, *podos*, foot), an order of crustaceans having sessile eyes and a depressed body; the thoracic and abdominal rings free, except the first thoracic, which is united with the head. The feet are of equal size and move in the same direction. The Isopoda vary widely in habits; some, like the woodlice, are terrestrial, and inhabit damp situations, such as under stones, and moss, and under the bark of trees; others live as parasites on fishes, and in the gill-chambers or on the outer surface of shrimps, crayfish, &c.; and whilst some forms are exclusively marine, others inhabit fresh water.

Isos′tasy, a theory in geology and geodesy. *Geology.*—Surface areas that receive a load of sediment washed down from the uplands tend to press towards those uplands, which are at the same time being lightened of their load. There is thus an isostatic conservation of earth-features; the mountainous masses, though undergoing prolonged denudation, tend to rise. Isostasy does not account for the earth-pressures that produce crumpled mountain-chains; but it is a cause of the perpetuation of these chains. The mountains are conceived as masses of lesser density floating in denser matter belonging to lower layers of the crust, which supports them by its lateral thrust.

Geodesy.—Gravity surveys, conducted generally with the pendulum, find by actual measurement the resulting effect of gravitation and of centrifugal force due to the earth's rotation. Gravitation varies inversely, however, as the square of the distance between the centre of the earth (from which the attraction of the earth's mass is supposed to act) and the place of experiment. It is also affected by any mass above mean sea-level which is, as it were, superimposed on the theoretical figure of the earth at this spot (see *Geodesy*; *Gravity*). In order to make measurements of gravity universally comparable, they are reduced to mean sea-level by eliminating the effect of extra height and of superimposed masses.

Bouguer in his famous experiment in Peru proceeded on the supposition that the earth's crust was rigid, and that any superimposed mass was wholly additional to that of the theoretical figure of the earth.

His formula for reduction to mean sea-level was

$$g' = g + (1 - 3\delta/4\Delta)2gh/r,$$

where g' is the observed gravity,
g ,, gravity at sea-level,
h ,, elevation above mean sea-level,
r ,, radius of the earth,
Δ ,, mean density of the earth,
δ ,, density of the local and superimposed mass.

Observed results for g give, however, discordant values when treated in this way, and the discordance is almost always in such a sense as to imply that the additional effect due to superimposed mass has been exaggerated. The late Professor Helmert is perhaps the most famous geodesist who has treated observed values of gravity on the assumption that the additional mass due to height above mean sea-level is counterbalanced or compensated by an equivalent lack of density in the underlying portion of the earth's crust, but that the net result is a compensation at mean sea-level itself. Consequently in his reduction formula he omits the term which allows for the attraction of the superimposed mass, and takes into account only the additional distance from the earth's centre.

Helmert's 1901 formula, obtained by this method (the 'free-air method'), is

$$g' = g + \frac{2gh}{r}.$$

Again, however, the reduced results for g are not harmonious. In place of negative residuals (found in the Bouguer reduction), the free-air method gives, on the whole, positive residuals, implying that the superimposed mass is not to be ignored.

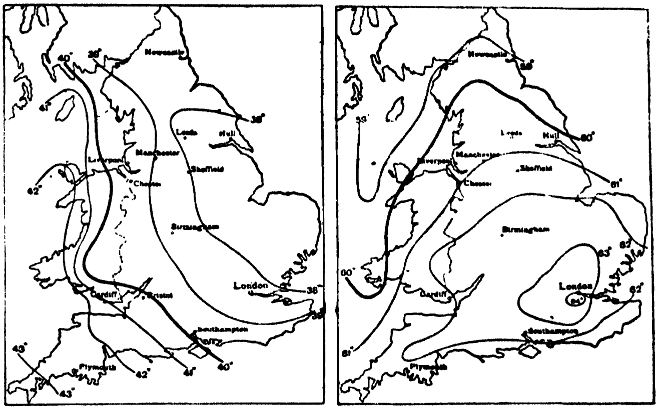
Arguing from these premises, geodesists have advanced the theory of *isostasy*, which agrees generally with observed results. The theory considers the interior of the earth as homogeneous, and the crust to be yielding and to some extent viscous. In this crust it is postulated that masses above mean sea-level are compensated for by underlying regions of deficient density, and that areas of extra density underlie ocean-beds. We may then consider a number of cylinders of equal section thrust downwards in the direction of the plumb-bob through the crust to rest upon an equipotential surface.

The theory of isostasy argues that the masses enclosed in these cylinders will be equal, and that although V (the volume) will vary, δ (the density) will vary in an equal and opposite sense. Each of these cylinders will, however, exert its influence upon the pendulum, and since this influence may be considered as acting from the centre of gravity, the height of the centre of gravity will determine the direction of the resulting attraction. We may also divide this attraction into components due to the mass above mean-sea-level and the underlying depth of compensation. It is to be noted that the theory of isostasy may be tested both by pendulum (or gravity) measurements and by measurements of the inclination of the plumb-bob. The former deals with the intensity of the attraction, the latter with its direction.

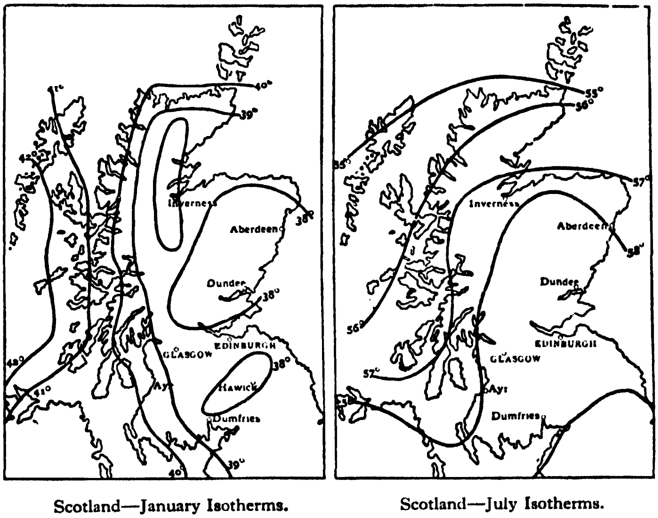
It is apparently to Major C. E. Dutton that the name ‘isostasy’, used by him in 1889, is due, but the theory has been known and accepted by geodesists and geologists for many years. The first extended mathematical treatment of the subject was given by Archdeacon Pratt in his investigations on the deflection of the plumb-bob in India from 1859 onward. A theory of such wide application needs confirmation from a careful arrangement and analysis of measurements at stations covering a wide area. The Coast and Geodetic Survey of the United States of America has supplied a mass of such measurement, and it is due to Hayford and Bowie of that survey that we have the calculations and the analysis which has placed the general truth of the theory beyond question. The survey of India, under Sir Sydney Burrard, has contributed to its experimental confirmation.

At the present moment it may be said that the depth of compensation appears to be about 70 to 80 miles, and acts as if it were concentrated at a depth of from 20 to 30 miles. It appears to vary somewhat according to the geological formation, and to allow of considerable local deviations from the general law.—Bibliography: *Survey of India* (Professional Paper, No 13); *United States Coast and Geodetic Survey* (Special Publications, Nos. 10, 17, and 40).

Isother'mal Lines, lines drawn on a map or globe through places which have the same mean annual temperature. (See *Climate.*) *Isotheral* lines are drawn through places having the same mean temperature during the hottest month of the year. *Isocheimenal* or *isocheimal* lines are drawn through places having the same mean temperature during the coldest month of the year.



England—January Isotherms. England—July Isotherms.



Scotland—January Isotherms. Scotland—July Isotherms.

The figures represent the temperature in degrees Fahrenheit.

Isotopes, elementary substances with the same chemical properties, but different atomic weights; or, elements with different atomic weights, but the same atomic number (see *Matter*; *Number, Atomic*), and the same place in the *periodic table* (q.v.). According to modern theory, as developed by Sir E. Rutherford and others, and now fairly well established, an atom is built up of a certain number of unit positive charges of electricity, or *protons*, with an equal number of unit negative charges, or *electrons* (q.v.). The positive charges, in which practically all the mass of the atom resides, are concentrated in a nucleus of minute dimensions, closely bound to some of the negative charges. Only those electrons which are outside the nucleus take part in chemical changes. The number of outside electrons, or the *net* number of positive charges in the nucleus, is the atomic number. Elements with the same atomic number ought therefore to be chemically alike, and elements with the same gross number of protons ought to have the same atomic weight. If an element loses one proton and one electron from the nucleus, its atomic weight will be reduced by 1, but its atomic number and its chemical properties will not be changed. The new element will be an *isotope* of the old. This theory has been verified in two main ways, the one depending on the facts of radio-activity (q.v.), the other on a series of remarkable experiments by F. W. Aston, working with a developed form of Sir J. J. Thomson's positive ray analysis (see *Rays, Electric*). Aston's results form a contribution of the very highest interest and importance to our knowledge of the structure of matter.

The element lead is the end product of various series of radio-active changes. The uranium series (e.g.) ends with a product which has a theoretical nuclear charge 82, the same as that of lead. This product is derived from radium by five α-ray changes. The atomic weight of radium is 226, and each α-ray change, or loss of a helium atom, lowers the atomic weight by 4. The atomic weight of the final lead should therefore be 206, whereas ordinary lead has an atomic weight 207·2. It has been completely verified by experiment that the final product of the uranium series is chemically identical with lead, but has the at. wt. 206. Many other examples of this type are known, and the existence of isotopes among radio-active bodies is now beyond question.

Among the lighter and non-radioactive elements the first indication of the existence of isotopes was given by the experiments of Sir J. J. Thomson on the inert element neon. The atomic weight of neon is 20·2, but positive ray analysis gave *two* parabolas corresponding to atomic weights of 20 and 22. At first it was thought that neon is really not a single element, but a mixture of two distinct elements (as air is a mixture of oxygen, nitrogen, &c.), composed of 10 per cent of one element of at. wt. 22, and 90 per cent of another of at. wt. 20. After the practical failure, however, of various attempts to separate the two components of neon, a somewhat different view of the matter came to be taken. It had long been observed as a curious fact that many atomic weights, on the basis of O = 16, are very nearly whole numbers; and, indeed, a theory, known as *Prout's hypothesis*, had been advanced in 1815 suggesting that every atom is built up of atoms of hydrogen, and that every atomic weight in terms of hydrogen is therefore a whole number. The theory did not stand the test of the exact determinations of atomic weight by Stas and others, who found that the at. wt. of chlorine, for instance, is 35·46 correct to the last figure. The facts about neon, however, as well as the trend of theoretical speculation, suggested interesting possibilities for elements in general; and in 1919 Aston began systematic work to test whether there might not be some substratum of truth in Prout's idea after all. Aston uses an instrument which he calls the 'mass-spectrograph'. Positive rays, which are charged atoms and molecules moving at high speed, are generated in a large discharge tube, and pass through two fine slits in the cathode. The space between the slits, and the 'camera' in which the analysis takes place, are highly exhausted. The rays are deflected by being made to pass between two charged plates, and then between the poles of a powerful electromagnet. It can be shown that rays of the *same mass* will come to a focus in a certain plane, and a sensitive plate is placed there. The record on the plate is therefore a *mass-spectrum*, and can be used to detect the presence of particular elements in the positive rays in much the same way as the ordinary solar spectrum is used for the discovery of elements in the sun. Aston has investigated a large number of elements, chiefly non-metals, and he finds in all cases that an element either has an integral atomic weight, or else is made up of two or more isotopes with integral atomic weights, the chemical at. wt. in the latter case being therefore merely a statistical average. Chlorine gave lines on the mass-spectrum corresponding to 35, 36, 37, 38, of which 35, 37 certainly belong to chlorine itself, the other two possibly to HCl. There was no sign of a line at 35·46. Among elements found to be single are helium, carbon, nitrogen, oxygen, fluorine, phosphorus, arsenic, sulphur, sodium, and cæsium. The accepted at. wts. of these are nearly whole numbers. Boron, bromine, lithium, and potassium are composed of two isotopes each, with masses of 11, 10; 79, 81; 7, 6; 39, 41 respectively; the corresponding atomic weights are 10·9, 79·92, 6·94, 39·1. Mercury (at. wt. 200·6) has several isotopes, ranging from 197 to 204; Brönsted and Hevesey, at Copenhagen, have succeeded by physical methods in partially separating these, with results consistent with those given by Aston.—**Bibliography:** F. W. Aston, *Science Progress* (Oct., 1920); *Nature*

(12th May, 1921); *Philosophical Magazine* (1919, p. 707; 1920, pp. 449, 611, 628; 1921, pp. 140, 436); J. N. Brönsted and G. Hevesey, *Philosophical Magazine* (1922, p. 31).

Ispahan (is-pà-hän′), or **Isfahan**, a very ancient city of Persia, and for centuries its capital, in the province of Irak-Ajemi, on the River Zendarud, 200 miles south of Teheran, the present Persian capital. It was once one of the most important and magnificent cities in the East, but little is now left of its former splendour, the largest part of the city being in ruins. The manufactures are still extensive, however, including trinkets, fire-arms, sword-blades, glass, earthenware, artistic brasswork, woollens, cottons, velvet, and satin. Much opium is grown in the neighbourhood, as also are tobacco and madder, forming important articles of trade. Ispahan is an important emporium of the inland commerce of Persia, and is a centre for the distribution of goods from Britain, Russia, India, &c. British goods arrive partly by way of Bushire, on the Persian Gulf, coming via Shiraz, or they may enter the country by way of the River Karun and the town of Ahwaz. The town was occupied by the Russians during the European War (in 1915). Pop. 90,000.

Israëls, Joseph, Dutch painter, born at Groningen, of Jewish parents, in 1824, died 1911. He studied at Amsterdam and at Paris, and after returning to Amsterdam, finally settled at The Hague in 1870, where he became a prominent figure in the revival of Dutch painting associated with that town. His first important picture was historical in subject, *William, Prince of Orange, opposing the Decree of the King of Spain*, but soon he abandoned such subjects for scenes of working-class life, delighting especially in studies of fisher folk. Of this character are his *Children of the Sea* and *Evening on the Shore* (Salon, 1857). Other important works of his are: *The Zandvoort Fisherman*, *The Silent House*, *Shipwrecked* (now in the National Gallery), and *The Bric-à-brac Seller*, whilst his etchings include: *Old Mary*, *The Cradle*, and *The Mother*. One of his latest paintings is *David Singing before Saul*. In the handling of his subjects he owes much to Rembrandt; and in the sources of his inspiration he is comparable to Millet, though he does not achieve that painter's dignity and breadth of treatment.

Issik-kul, or **Issyk-kul**, a lake of Central Asia, in Russian Turkestan, province of Semirechensk, south of Lake Balkhash, about 110 miles long by 36 miles broad, with brackish water abounding in fish. It is the largest of the upland lakes, lying in the heart of the Tian-shan at an altitude of 5300 feet, and receives many streams, but is gradually decreasing in size.

Issoudun (is-ö-düṇ; the Roman *Exoldunum*), a French town, department of Indre, 17 miles N.E. of the departmental capital, Châteauroux. It has manufactures of steam-engines, agricultural implements, tools and various articles in metal, and parchment. Pop. 10,246.

Issue, in law, the point or matter depending in a suit on which two parties join and put their cause to trial. It is a single, definite, and material point issuing out of the allegations of the parties, and consisting regularly of an affirmative and negative. It is either an *issue in law* to be determined by the court, or *in fact* to be ascertained by a jury. In testamentary deeds the term is frequently used to denote descendants.

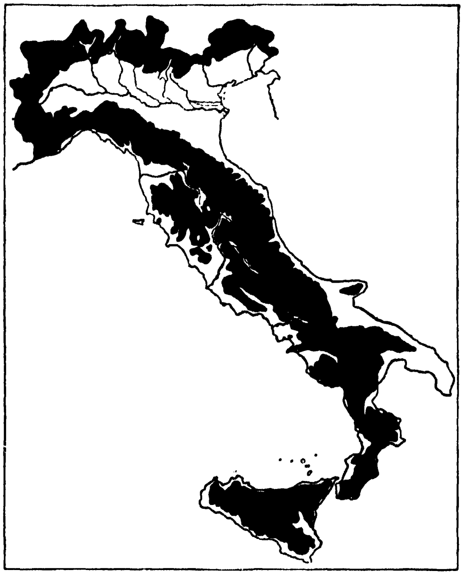
Issus, anciently a town of Cilicia, in Asia Minor, on the Gulf of Issus. Here Alexander the Great gained a complete victory over Darius (333 B.C.).

Isthmian Games, public games of ancient Greece, so called because they were celebrated on the Isthmus of Corinth, and having a similar character to the Olympian, Nemean, and Pythian games. The Greeks in general took part in them, and the principal exercises were boxing, wrestling, foot-, horse-, and chariot-races, and throwing the discus. They were celebrated in April and May, in the first and third year of each Olympiad, and the victors were rewarded with wreaths of pine leaves. The origin of these games was lost in antiquity, but they were generally regarded as originated in honour of Poseidōn (Neptune). The regular celebration of the games was dated from 582 B.C.—Cf. E. N. Gardiner, *Greek Athletic Sports and Festivals*.

Is′tria, a peninsula of triangular form, projecting into the north-east corner of the Adriatic Sea. The surface is mountainous, particularly in the north. The soil is generally thin and gravelly; but the forests, which are extensive, yield excellent timber, and the vine, olive, and mulberry are successfully cultivated. It formerly belonged to the Austrian Empire, but passed to Italy in Nov., 1920, after the settlement of the Adriatic question. Area, 1913 sq. miles. Pop. 350,000, of which a third are Italians, and the rest Croats and Slovenes.

Itacolumite, a laminated light-coloured sandstone, consisting of fine quartz grains, and flakes of mica, talc, and chlorite. In Brazil both gold and diamonds are found in itacolumite. Owing to minute interstices and interlockings of the grains, some layers of the rock are flexible.

Italy, a kingdom in Southern Europe, consisting in the main of a large peninsula which stretches southwards into the Mediterranean, but also including a considerable portion of the mainland and the Islands of Sicily, Sardinia, Elba, Ischia, and the Lipari Islands. It is bounded on the north and north-west by the Alps, which separate it from Austria, Switzerland, and France, and on the north-east by Yugo-Slavia; elsewhere it is washed by the Mediterranean, or the Adriatic, an arm of the latter. Before the European War the area of Italy was 110,632 sq. miles, but as a result of the collapse of Austria the territory was increased, and Italy now comprises an area of about 118,000 sq. miles, and a population of over 36,000,000. For administrative purposes it is divided into sixty-nine provinces, which are grouped under sixteen departments (*compartimenti territoriali*), some of them consisting of only a single province.



Highlands of Italian Peninsula

Land over 1000 feet shown black, under 1000 feet shown white.

From 1861, when the Kingdom of Italy was constituted, until 1865, Turin was the capital, Florence was then selected, and in 1871 Rome. The largest town is Naples; next in order of importance are Milan, Rome, Turin, Palermo, Genoa, and Florence. Italy possesses the territory of Eritrea (Erythræa) on the east or Red Sea coast of Africa, a part of Somaliland, and Tripoli and Cyrenaica (Libia Italiana).

Physical Features. — Amongst the principal physical features of Italy are the Alps on its northern frontiers, and the chain of the Apennines, which run down the middle of the peninsula through its whole length to the Straits of Messina, while numerous branches are thrown off laterally, and form an endless succession of wooded hills, olive-clad slopes, and fertile valleys. In the north, enclosed between the ranges of the Alps and Apennines, is a vast and fertile plain, intersected by the Po and its tributaries. Two active volcanoes belong to the kingdom, Vesuvius in South Italy and Etna in Sicily. The eastern shore of Italy is generally flat and uninteresting, presenting particularly along its northern part a series of sandy islands and lagoons, which dam up the mouths of the rivers, and occasion the formation of pestilential marshes. On the west coast the same thing is occasionally seen, as in the case of the Pontine Marshes and the Tuscan Maremma; but as a rule the west coast is more elevated, and often presents delightful scenery, as round the Gulf of Genoa and the Bay of Naples. The only river of any magnitude is the Po, which has a length of about 450 miles before it enters the Adriatic. It is fed by streams both from the Alps and the Apennines, the Ticino, Adda, Oglio, &c., from the former, the Trebbia, Secchia, &c., from the latter. The Adige (in Germany, the Etsch) has its mouth at no great distance from the Po, and is partly fed in the same way. In the peninsular part of Italy are the Arno, Tiber, Garigliano, Volturno, &c., There are a number of lakes, of which the most important are Lakes Maggiore, Lugano, Como, and Garda in the Alpine region; Lakes Trasimeno, Bolsena, and Albano in the Apennine region. Italy is rich in useful minerals, but the scarcity of coal prevents the full development of mining industry. Sulphur, marble, zinc, salt, iron, and borax are the chief, though small quantities of lead, copper, silver, &c., are also obtained.

Climate.—In the south of Italy the climate resembles that of Africa, being dry and burning and subject to the sirocco. In the northern regions, the neighbourhood of the Alps, and the abundance of watercourses, serve to maintain a pleasant temperature. Yet this region is at times extremely cold, especially in the interior of the great plains. In general the climate of Italy is healthy, except in marshy districts such as the rice-plantations of Lombardy, the Tuscan Maremma, the Campagna of Rome, and the Pontine Marshes, which give rise to exhalations engendering fevers. The Riviera or coast of the Gulf of Genoa is a favourite winter-resort from more northern regions.

Vegetable Products, Agriculture.—The natural productions of the soil of Italy are as various as its climate. In the Alpine regions all plants belonging to temperate climates flourish, while the southern regions possess almost a tropical flora. Agriculture forms the chief support of the population, and the land, where not mountainous, is generally productive, although the system of culture adopted is in most parts defective, and large areas remain untilled. The best cultivation, aided by an excellent system of irrigation, is found in Lombardy, Venetia, Piedmont, Tuscany, and the parts of Emilia adjoining the Po. Most kinds of cereals, including rice and maize, are cultivated, and the wheat in particular is of fine quality, but is not sufficient for the home consumption. Hemp, flax, tobacco, hops, saffron, and, in the extreme south, cotton and sugar-cane are cultivated. Fruits are the object of attention everywhere; and in the cultivation of the olive Italy surpasses all other European states. The fruits include oranges and lemons in the warm regions of the south, besides figs, peaches, apricots, almonds, &c. There is a very large production of wine, but only a few of the wines have any reputation in other countries. The rearing of live stock is an important industry. The cheese of Italy is famous, especially the Gorgonzola and the Parmesan.

Manufactures.—Since the consolidation of the Italian kingdom, manufactures have made great advances, and electricity generated by water-power, derived from her mountain streams, has come much into use. Thanks to this fact Italy has changed from a purely agricultural country to an industrial one. Unfortunately, however, one of the results of this industrial ambition has led to the development of socialism, syndicalism, strikes, revolutionary activity, and social unrest. The silk industry is the chief, Italy as regards the production of raw silk being in advance of all the other countries of Europe. Lombardy, Piedmont, and Venetia are the great centres for the preparation of the raw silk and its manufacture into thread and tissues. The cotton manufactures are also centred in Upper Italy, chiefly in Lombardy, and have much increased. Woollen manufactures are also chiefly carried on in Upper Italy. In the iron industry and in engineering the department of Lombardy stands at the head, more particularly the provinces of Brescia, Como, and Milan. Tanning, the manufacture of linen, of paper, gold and silver wares, musical instruments, gloves, boots and shoes, felt and silk hats, are also considerable industries. The manufacture of tobacco is a State monopoly. Of special repute are the cameos and mosaics of Rome, Naples, and Florence; the filigree and coral work of Genoa; the plaited straw and the earthenware of Italy generally.

Trade.—The foreign trade since 1914 has been mainly with France and Algeria, Great Britain, Switzerland, and the United States. In 1918 the imports, exclusive of precious metals, amounted to the value of £641,547,036; the exports to £133,788,269. The chief imports are wheat, raw cotton, and cotton manufactures, coal, iron, and machinery, wool, sugar, coffee; the chief exports, raw silk, olive-oil, wine, fruits, eggs, coral, hemp, marble, rice, sulphur. The principal ports are Genoa, Leghorn, Messina, Naples, Palermo, Venice, Brindisi, and Catania. The total length of railways opened for traffic in 1919 was 9741 miles; of telegraph lines, 34,733 miles, mainly belonging to the Government.

Constitution and Government.—The constitution of the Kingdom of Italy is a limited monarchy, based upon the Fundamental Statute granted by King Charles Albert to his Sardinian subjects, 4th March, 1848. The king, who is hereditary, exercises the power of legislation in conjunction with a national Parliament, consisting of two chambers. The first chamber is called the Senate, and is composed of the princes of the blood, and an indefinite number of members appointed for life by the king. There were 368 Senators and nine members of the royal family in 1920. The second chamber is called the Chamber of Deputies, and consists of 508 members, who are elected by a majority of all citizens above twenty-one years of age who can read and write, and possess certain other qualifications. The Electoral law of 1918 made the suffrage universal not only for men above twenty-one, but also for men aged less than twenty-one years but who had performed military service during the war. The principle of proportional representation was introduced by the Electoral Reform Act of 1919. The duration of Parliament is five years. Each province has a separate adminstration, and a Provincial Council, the power of the State being represented by a Prefect, who is supported by a Council. The executive power of the State is exercised by the king through a Cabinet of responsible ministers. In 1920–1 the estimated revenue was £493,960,752 (12,349,018,815 lire), the estimated expenditure £999,551,714 (24,988,792,859 lire). The public debt amounts to more than 719,300,000 lire.

Army and Navy.—All men capable of bearing arms are under obligation of military service from their twenty-first to the end of their thirty-ninth year. The army is divided into three main branches: the standing army, the mobile militia, and the territorial militia. Only a comparatively small number serve with the colours for any length of time, and those that form the territorial militia have but a very slight training. The strength of the field army at the end of 1919 was 800,000, but it was proposed to reduce it to 250,000. Italy mobilized during the European War 5,615,000 men. The navy numbers 6 dreadnoughts, 6 pre-dreadnoughts, 5 armoured cruisers, besides protected cruisers, destroyers, torpedo-gunboats, submarines, and other craft.

Religion and Education.—The Roman Catholic is nominally the State religion, but all other creeds are tolerated, and adherents of all religions have equal municipal and political rights.

The Pope has his seat at Rome, and his palaces of the Vatican and the Lateran, and his villa of Castel Gandolfo, are not under the jurisdiction of the State. In 1861 the law annihilating ecclesiastical jurisdiction and the privileges of the clergy was extended to the whole of the kingdom, and in 1866 a Bill was passed for the suppression (with certain exceptions) of religious houses throughout the kingdom. Elementary education is nominally compulsory, and is entirely supported from the municipal rates; but the number who can neither read nor write still remains very large. For secondary instruction there are a large number of gymnasia and technical schools, and for the higher education there are no fewer than twenty-one universities, many of them of ancient foundation, and at one time of considerable renown. The oldest are those of Bologna (founded in 1200), Padua (1222), Naples (1224), Genoa (1243), Siena (1300), Rome (1303), Pavia (1300), Pisa (1338), Turin (1404), and Parma (1502).

Money, Weights, and Measures.—The present monetary system of Italy is the same as that of France, the lira being equal to the franc, and divided into 100 centesimi, as the franc is into 100 centimes. The normal value of the lira is, therefore, equal to about 9½*d.* The weights and measures of Italy are also on the metric system, and have been adopted from France with only such modifications in their names as are necessary to give them an Italian form.

History.—The ancient history of Italy will be found under *Rome.* The modern history begins with A.D. 476, when Odóacer, chief of the Herulians, a German tribe who had invaded the country, was proclaimed King of Italy. After a reign of twelve years he and his followers were overpowered by the Ostrogoths under Theodoric the Great. The Ostrogoths were in turn subdued by Byzantine troops, and Italy came under the dominion of the Eastern emperors, who ruled through an exarch residing at Ravenna. In 568 the Lombards (Langobardi), a German people originally from the Elbe, led by their king, Alboin, conquered the Po basin, and founded a kingdom which had its capital at Pavia. The Kingdom of the Lombards included Upper Italy, Tuscany, and Umbria, with some outlying districts. But on the north-east coast the inhabitants of the lagoons still retained their independence, and in 697 elected their first doge, and founded the Republic of Venice (q.v.). Ravenna, the seat of the exarch, with Romagna, Rimini, Ancona, and other maritime cities on the Adriatic, and almost all the coasts of Lower Italy, remained unconquered, together with Sicily and Rome. The slight dependence of this part of Italy on the court of Byzantium disappeared almost entirely in the beginning of the eighth century. The power of the Pope, though at first recognized only as a kind of paternal authority of the bishop, grew steadily in these troubled times, especially in the struggle against the Lombard kings. In consideration of the aid expected against King Astolphus, Pope Stephen III (754) not only anointed the King of the Franks, Pepin, but appointed him Patrician or Governor of Rome. In return Pepin presented the exarchate of Ravenna, with the five maritime cities, to the Pope, thus laying the foundation of the temporal power of the Holy See. At the invitation of Pope Hadrian I Charlemagne made war upon Desiderius, the King of the Lombards, took him prisoner in his capital, Pavia (774), and united his empire with the Frankish monarchy. Italy, with the exception of the Duchy of Benevento and the republics of Lower Italy, thus became a constituent part of the Frankish monarchy, and the imperial crown of the West was bestowed on Charlemagne (800). On the breaking up of the Carlovingian Empire Italy became a separate kingdom, and the scene of strife between Teutonic invaders. At length Otto the Great was crowned emperor at Rome (961), and the year after became emperor of what was henceforth known as the Holy Roman Empire (q.v.).

During the following centuries the towns and districts of North and Middle Italy gradually made themselves independent of the empire, and either formed themselves into separate republics or fell under the power of princes bearing various titles. A large part of Middle Italy at the same time was under the dominion of the Popes, including the territory granted by Pepin, which was afterwards enlarged on several occasions. In Southern Italy there were in the time of Charlemagne several independent states. In the ninth century this part of the peninsula, as well as Sicily, was overrun by Saracens, and in the eleventh century by Normans, who ultimately founded a kingdom which embraced both Lower Italy and Sicily, and which, though it more than once changed masters, continued to exist as an undivided kingdom till 1282. In that year Sicily freed herself from the oppression of the then rulers, the French, by the aid of Pedro of Aragon (see *Sicilian Vespers*), and remained separate till 1435. It was again separate from 1458 to 1504, when both divisions were united with the crown of Spain. With Spain the kingdom remained till 1713, when Naples and Sicily were divided by the Treaty of Utrecht, the former being given to Austria, the latter to the Duke of Savoy. In 1720 they were again united under Austria, but in 1734 were conquered from Austria and passed under the dominion of a separate dynasty belonging to the Spanish House of Bourbon. See *Sicily*; *Naples.*

The history of mediæval Italy is much taken up with the party quarrels of the Guelfs and Ghibellines, and the quarrels and rivalries of the free republics of Middle and Upper Italy. In Tuscany the party of the Guelfs formed themselves into a league for the maintenance of the national freedom under the leadership of Florence: only Pisa and Arezzo remained attached to the Ghibelline cause. In Lombardy it was different, Milan, Novara, Lodi, Vercelli, Asti, and Cremona formed a Guelf confederacy, while the Ghibelline league comprised Verona, Mantua, Treviso, Parma, Placenza, Reggio, Modena, and Brescia. Commercial rivalry impelled the maritime republics to mutual wars. At Meloria the Genoese annihilated (1284) the navy of the Pisans, and completed their dominion of the sea by a victory over the Venetians at Curzola (1298).

Up till the time of the Napoleonic wars Italy remained subject to foreign domination, or split up into separate republics and principalities. The different states were bandied to and fro, by the chances and intrigues of war and diplomacy, between Austria, Spain, and the House of Savoy. During the career of Napoleon numerous changes took place in the map of Italy, and according to an Act of the Congress of Vienna in 1815 the country was parcelled out among the following states: (1) The Kingdom of Sardinia, consisting of the Island of Sardinia, Savoy, and Piedmont, to which the Genoese territory was now added; (2) Austria, which received the provinces of Lombardy and Venetia, these having already been acquired by her either before or during the time of Napoleon; (3) the Duchy of Modena; (4) the Duchy of Parma; (5) the Grand-Duchy of Tuscany; (6) the Duchy of Lucca; (7) the States of the Church; (8) the Kingdom of the Two Sicilies; (9) the Republic of San Marino; (10) the Principality of Monaco. The desire for union and independence had long existed in the hearts of the Italian people, and the Governments at Naples, Rome, Lombardy, and other centres of tyranny were in continual conflict with secret political societies. The leading spirit in these agitations in the second quarter of the nineteenth century was Giuseppe Mazzini, who in the end contributed much to the liberation of his country. The French Revolution of 1848 brought a crisis. The population of Lombardy, Venetia, Parma, and Modena took up arms and drove the Austrian troops in retreat to Verona. Charles Albert, King of Sardinia, then declared war against Austria, and was at first successful, but his forces were severely defeated at Novara (March, 1849), when Charles Albert abdicated in favour of his son Victor Emmanuel. Meanwhile the Pope had been driven from Rome, and a Roman republic had been established under Mazzini and Garibaldi, the leader of the volunteer bands of Italian patriots. Rome was, however, captured by the French, who came to the aid of the Pope (July, 1849), who resumed his power in April, 1850, under the protection of the French, and the old absolutism was restored. Similar attempts at revolution in Sicily and Naples were also crushed, but the secret societies of the patriots continued their operations. In 1859, after the war of the French and Sardinians against Austria, the latter power was compelled to cede Lombardy to Sardinia, and in the same year Romagna, Modena, Parma, and Piacenza were annexed to that kingdom, which was, however, obliged to cede the provinces of Savoy and Nice to France. In the south the Sicilians revolted, and supported by a thousand volunteers, with whom Garibaldi sailed from Genoa to their aid, overthrew the Bourbon government in Sicily. Garibaldi was proclaimed dictator in the name of Victor Emmanuel. In August Garibaldi crossed to Naples, defeated the royal army there, drove Francis II to Gaeta, and entered the capital on the 7th Sept. Sardinia intervened and completed the revolution, when Garibaldi, handing over his conquests to the royal troops, retired to Caprera. A plebiscite confirmed the union with Piedmont, and Victor Emmanuel was proclaimed King of Italy, thus suddenly united almost in Mazzini's phrase, "from the Alps to the sea". Only the province of Venice and the Roman territory still remained outside. The former was won by Italy's alliance with Prussia in 1866 against Austria. The temporal power of the Pope was still secured by French troops at Rome, till the French garrison was withdrawn at the outbreak of the Franco-German War in 1870, when Italian troops took possession of the city in name of King Victor Emmanuel. On 30th June, 1871, the seat of government was formally removed from Florence to Rome. In 1878 Victor Emmanuel died, and was succeeded by his son Humbert I. In 1900 Humbert was assassinated, and his son Victor Emmanuel III ascended the throne.

In 1882 Italy had joined Austria and Germany in the Triple Alliance, which was renewed in 1887, 1891, 1902, and 1912. A movement, however, was set on foot for the purpose of crushing German influence in the country, and of recovering the territories occupied by foreigners but Italian on account both of language and nationality. Such territories were chiefly the Trentino, and Trieste, or Istria (Italia Irredenta, or unredeemed Italy). In 1912 Italy obtained Tripoli and Cyrenaica from the Ottoman Empire. In July, 1914, Austria delivered her ultimatum to Serbia, and the European War broke out, but as Italy had not been consulted by Austria, she considered herself freed from any obligation towards the two other members of the Triple Alliance and declared her neutrality. The Irredentists, however, were at work, and their hopes of recovering Italia Irredenta grew daily. A strong interventionist party, urging the Government to join the Allies, was formed, and on 23rd May, 1915, the Italian Government under Salandra, who had succeeded Giolitti in Sept., 1914, declared war against Austria. Salandra, however, who had not conducted the war with sufficient vigour, was succeeded by Boselli in June, 1916. His Cabinet included Sonnino and Orlando. On the 27th Aug. war was declared on Germany by the Italian Government. In consequence of the disaster of Caporetto in 1917 a Cabinet crisis arose, and a new ministry was formed under Orlando as Premier. After the conclusion of the war, the Italian Imperialists, flushed with success and victory, demanded that Italy should be given not only the Trentino and Trieste, but also Fiume, and the entire Dalmatian coast of the Adriatic with the adjacent islands. The Serbians, and later the newly-formed state of Yugo-Slavia, naturally opposed such demands. Orlando, having failed to obtain recognition of the Italian point of view at the Paris Conference, was defeated in the Italian Chamber on 19th June, 1919. He was succeeded by Signor Nitti as Premier, who, in his turn, was succeeded by Giolitti. Serious disturbances took place towards the end of 1920 in Italy, the industrial workers of Turin and Northern Italy having resorted to extreme action. By the Treaty of Rapallo Italy received Istria with the neighbouring islands, and Zara in Dalmatia, whilst the remaining portion of Dalmatia was handed over to Yugo-Slavia.—BIBLIOGRAPHY: T. Hodgkin, *Italy and her Invaders*; A. H. Gifford, *New Italy*; E. Hutton, *Italy and the Italians*; Bolton King, *History of Italian Unity*; B. King and T. Okey, *Italy of To-day*; W. R. Thayer, *Dawn of Italian Independence*; C. L. Duff-Gordon, *Home Life in Italy*; J. Burckhardt, *The Civilisation of the Renaissance*; J. A. Symonds, *The Renaissance in Italy*; T. N. Page, *Italy and the World War*; Helen Zimmern, *Italy and the Italians*.

Literature.—The Italian language is one of the Romance tongues, or tongues derived from the Latin, and is therefore a sister of French, Spanish, and Portuguese. It is derived not from the literary language of Rome as we know it, but from the old popular dialect or *Lingua Romana rustica*. The invasions of the German races hastened the development of a new popular idiom, but the German languages exercised no essential influence on the grammatical structure of the new speech, although they contributed a number of words to its vocabulary. The oldest monuments of Italian literature go little farther back than the beginning of the thirteenth century. The Latin language kept its place so long here in its natural home that the new popular speech was slow to develop; and in fact the earliest literary products of Italy are poems written in the Provençal and French languages. But about the close of the thirteenth century native poets arose, who indeed imitated the Provençals as to the form of their compositions, but wrote in their own language. Among the most important of these early poets is the Florentine Guido Cavalcanti (died 1300), who contributed much to the development of Italian language and poetical style. But the great luminary of this period, and by far the greatest poetic genius which Italy has produced, was Dante (q.v.), 1265–1321. In Italian prose the oldest book is Ristoro d'Arezzo's *Composizione del Mondo*, written about the middle of the thirteenth century. In this department Dante also takes a high place with his *Vita Nuova* and *Convito*. Francesco Petrarca (Petrarch; 1304–74), another of the great lights of Italian literature, exhibits in his sonnets and canzoni a vein less profound and transcendental than Dante's, but more humanly tender and passionate. Boccaccio (1313–75), a writer of great erudition and fertility, who produced classical translations, biographies, poems, &c., is Italy's first great story-teller. He is the master of the ornate classical style in prose to which he first gave high artistic form. His great work is the *Decamerone*, a collection of a hundred tales. Amongst the other productions of the time are the historical works of Villani Capponi and Dino Compagni, the latter of doubtful authenticity, the travels of the Venetian Marco Polo, and the letters of St. Catherine of Siena. Amongst the comic poets of the time are Bindo Bonichi, Cecco Nuccoli, Andrea Orgagni, and Antonio Pucci.

During the fifteenth century the intellectual energy of Italy was almost entirely absorbed in the study of the ancient classics. This period is known as the Renaissance, or the revival of arts and letters. Italy had at this time become wealthy by commerce, and was enjoying comparative peace. Her cities were full of learned Greek refugees from Constantinople; many of her states were ruled by families such as those of the Medici at Florence, the Este in Ferrara, the Gonzaga in Mantua, whose names are identified with the most munificent patronage of learning and art. In the midst of this classical enthusiasm there was some danger of the national literature and language being neglected, but towards the end of the century Italian literature revived with the *Canti Carnascialeschi* and *Ballate* of Lorenzo de' Medici and Poliziano, the chivalrous epic *Orlando Innamorato* of Boiardo,

the *Morgante Maggiore* of Luigi Pulci, and the *Mambriano* of Francesco Bello (Cieco of Ferrara).

During the first half of the sixteenth century the Renaissance movement perfected itself in every kind of art. In history the most noted names are Machiavelli (1469–1527) and Francesco Guicciardini (1482–1540). Among the great poets of the period are Lodovico Ariosto (1474–1533), author of *Orlando Furioso*, a romantic epic, written in continuation of the *Orlando Innamorato* of Boiardo, and Torquato Tasso (1544–95), whose *Gerusalemme Liberata* is Italy's chief heroic poem. Amongst the lyrists of this century we may mention Guidiccioni of Lucca, Pietro Bembo, Michelangelo Buonarroti, and Vittoria Colonna. Berni Cammelli and Grazzini deserve mention amongst humorous and burlesque writers, and Bandello amongst story-tellers. Better known, however, are Giorgio Vasari (1512–74), himself an eminent painter, but more celebrated as a delightful gossip on art and artists; Benvenuto Cellini (1500–70), the famous artist in metal, whose *Autobiography* is one of the most instructive lights on the spirit and manners of the age; and Giordano Bruno (1550–1600), a bold speculator and undaunted champion of liberty of thought. In the period which followed, poetical and imaginative literature degenerated into mannerism and affectation. Of exceptional power was Alessandro Tassoni (1565–1635), who wrote the *Secchia Rapita*, a burlesque epic, and unquestionably the most important poetical production in Italian of the seventeenth century. Salvator Rosa, also, better known as a painter, wrote satirical verse of some merit. But the most eminent names of this period are those of scientific and philosophic writers. Amongst the former are Galileo Galilei (1564–1642), Torricelli (1608–47), and Viviani (1622–1703); amongst the latter are Tommaso Campanella (1568–1639) and Giambattista Vico (1668–1744). Amongst historians the names of Sarpi, Davila, Bentivoglio, and Pietro Giannone deserve mention. Towards the end of the century a new school of poetry arose, which was mainly a reaction against the existing turgid and affected style. The Academy of Arcadia was instituted (1690) to promote simplicity of style and the choice of simple pastoral subjects. The Arcadians produced no considerable poet, the chief names being Crescimbeni, Gravina, Frugoni, Zappi, and Rolli.

About the middle of the eighteenth century a complete revolution took place in Italian literature, which was preceded and accompanied by a general elevation of public life. The influence of English and German literature began to communicate a more healthy tone to the national literature. Gasparo Gozzi (1713–86) in the periodical *L'Osservatore*, and Giuseppe Baretti in a journal called the *Frusta Letteraria*, contributed perhaps more than any others, by their forcible and lively satire, to bring about this improvement. In dramatic literature the libretti of Pietro Trapassi (1698–1782), better known by his assumed name of Metastasio, had considerable merit, though tending to over-refinement of sentiment and expression. In 1713 Scipione Maffei, celebrated also as an archæologist, produced the tragedy of *Merope*, highly lauded at that time. But the two great names in the Italian drama are, in comedy, Carlo Goldoni (1707–93), and in tragedy, Vittorio Alfieri (1749–1803). Towards the end of the century the writings of the publicists Gaetano Filangieri and Cesare Beccaria indicate the growth of a social science under the cover of treatises on legislation and penal laws.

From the intellectual and political ferment which arose about the beginning of the nineteenth century Italy in particular received a much-needed stimulus. In poetry Ugo Foscolo (1776–1827), though following classical models and traditions, writes with the force and novelty of a new epoch. Vincenzo Monti (1754–1828) had a rich poetic vein and a facile talent. Alessandro Manzoni (1784–1873) has given Italy a few lyrics of the first rank, but the work which has most contributed to give him the high place he holds in literature is his novel *I Promessi Sposi*. An equally high, if not a higher place, is due to the poetry of Leopardi. His prose is amongst the best that Italy has produced. Amongst the lesser though still notable names are Tommaso Grossi, Silvio Pellico, Giambattista Niccolini, a writer of dramas; Giovanni Berchet, a writer of songs and lyrics; and Giuseppe Giustè, the genial satirist. The historico-political writings of Vincenzo Gioberti (1801–52) and Giuseppe Mazzini (1805–72) contributed powerfully to stimulate the national feeling and to shape the course of events. In history proper Amari (*I Vespri Siciliani*), Gino Capponi (*Republica di Firenze*), Ricotti, Zamboni, and others are the best-known names. Amongst later and contemporary authors the two figures which stand out with permanent distinctness are Giosuè Carducci (1836–1907), poet, critic, and essayist, and Gabriele d'Annunzio (born in 1864), poet, novelist, and dramatist. Other writers are: Giovanni Prati (1815–84), Aleardo Aleardi (1812–78), Mario Rapisardi (1844–1911), Arturo Graf (1848–1913), Ada Negri (born in 1870), and Giovanni Pascoli (1851–1913), all poets of distinction. Giuseppe Giacosa (1847–1904) and E. A. Butti (1875–1910) are playwrights of distinction. Of the Italian critics we shall mention Francesco de Sanctis (1818–86), Alessandro d'Ancona (1835–1914), and Benedetto Croce. Among other authors of note are: Ruggero Bonghi, a biographer and essayist of superior rank and a frequent contributor to the periodicals; Edmondo de Amicis (1846–1908), a descriptive writer; Angelo de Gubernatis, a writer of literary biographies, &c.; and Cesare Lombroso (1836–1908), who developed Italian criminology. — BIBLIOGRAPHY: A. Gaspary, *History of Early Italian Literature to the Death of Dante*; R. Garnett, *History of Italian Literature*; G. A. Greene, *Italian Lyrists of To-day*; L. Collison-Morley, *Modern Italian Literature*.

Itch, known in medicine as *scabies*, is a disease of the skin due to a small insect, the acarus (*Sarcoptes scabiei*), just visible to the naked eye. The female insect is the cause of the disease, as she burrows under the epidermis and lays her eggs. The irritation produced gives rise to itching and also to the exudation of fluid in the form of vesicles on the surface of the skin. These may rupture and discharge fluid, or develop into pustules. When the irritation is long-standing the skin becomes much thickened.

The commonest parts of the body to be affected are the regions between the fingers, the wrists, the margins of the armpits, and the genital regions, but the condition, when untreated, may spread over most of the body surface. In children there is a greater tendency for the vesicles to become pustular and for complications to appear.

The patient's great complaint is itching, always most troublesome at night, and the most frequent complications to arise are impetigo and abscesses, and in long-continued cases, eczema.

In treatment the destruction of the acari is all that is necessary, and this done the patient will recover. Hot baths with thorough soaking, followed by vigorous rubbing and the application of sulphur ointment in some form should be the treatment on three successive days with a complete change of all underclothing on each occasion, and thorough disinfection of this clothing to avoid possible reinfection. This is satisfactorily carried out in the out-patient departments of hospitals, in school clinics, and, under supervision, in the homes of patients, and is effective in getting rid of the disease; but on active service in the army, with large numbers of men infected, when such means were not always possible, the disease proved much more resistant, and led to considerable damage among the troops by the resulting complications.

Itchen, formerly an urban district, but since 1920 a suburb of Southampton, in Hampshire. It is situated at the mouth of the River Itchen, 1 mile east of Southampton. Pop. 19,800.

Itch-mite (*Sarcoptes scabiei*), a minute animal of the class Arachnida, which produces itch in man. The female burrows in the skin, in which she deposits her eggs, that are hatched in about ten days, giving rise to this troublesome ailment,

Ith′aca, now **Thiaki**, one of the Ionian Islands, on the west of Greece, between the mainland and Cephalonia, 17 miles long, and not above 4 miles broad. It is rugged and uneven, and divided into two nearly equal parts, connected by a narrow isthmus. The inhabitants are industrious agriculturists and mariners, and build and fit out a considerable number of vessels. They seem to be of pure Greek race, and the women are famed for their beauty. Ithaca was the royal seat of Ulysses, and is minutely described in the *Odyssey*. Schliemann made important excavations, and identified several sites mentioned by Homer. Ithaki or Vathi, the modern capital, trades largely in oil, wine, raisins, and currants, and has a population of about 7000. That of the island is about 10,000.

Ithaca, a town of the United States, state of New York, about 1½ miles south of the head of Cayuga Lake, the seat of Cornell University (q.v.). Pop. 17,000.

Itin′erary, a list of the stations or places on the route between two important localities, together with the distances between them. Some ancient itineraries are of importance to geographers. Of these the most important are the *Antonine Itineraries*, including the *Itinerarium Provinciarum*, or a list of the routes through the Roman provinces of Europe, Asia, and Africa; and the *Itinerarium Maritimum*, exhibiting the most frequented tracks along the coasts and at sea; and the *Jerusalem Itinerary* (Itinerarium Hierosolymitanum), made by a Christian in 333 for the use of travellers from Burdigala (Bordeaux) to Jerusalem.

Ito, Hirobumi, Prince, Japanese statesman, born in 1838, died in 1909. In 1863 he came to London, and studied English life for over a year. From that time he played a great part in the rise of Japan. After holding posts in several Cabinets, in 1886 he became Prime Minister, a post which by 1901 he had held four times, resigning in that year. He paid several visits to Europe and the United States. In 1903 he was appointed President of the Privy Council; in 1905 Japan's first Resident-General in Korea, with the task of guiding that country in the way of reform. He was assassinated at Kharbin.

Itu, or **Ytu**, a town of Brazil, in the state of Sao Paulo, on the Tiete. It is the centre of a coffee-growing district. Pop. 11,000.

Iturbide (ē-tu̧r′bē-*dā*), Augustin de, a distinguished Spanish-American, born at Valladolid, in Mexico, in 1783, died in 1824. On the breaking out of the revolutionary troubles in Mexico he joined the Royalist party, and displayed such valour and ability that in 1815 he rose to the chief command of the army, but afterwards went over to the other side, quickly bore down all opposition, and became so popular that he proclaimed himself Emperor of Mexico in 1822. His reign was full of trouble, and came to an end in less than a year by his abdication. Congress granted him a yearly pension on condition of his leaving the country, and he resided in Leghorn about a year, when he made an attempt to recover the crown. He landed with but a single attendant, and was arrested and shot at Padilla on 19th July, 1824.

Itzehoe (it′se-hō), a town of Germany, in Holstein, in a valley enclosed by wooded hills, on the Stör, 32 miles north-west of Hamburg. It is the oldest town in Holstein, being founded by Charlemagne in 809. In 1866 it passed from Denmark to Prussia. Pop. 16,547.

I′van, or **Iwan**, the name of several rulers distinguished in Russian history.—**Ivan III** (or I), Grand-Prince of Moscow, was born 1440, ascended the throne 1462, died 1505. He greatly enlarged his hereditary possessions, and married Sophia, niece of the last Byzantine Emperor, thus introducing the double-headed Byzantine eagle into the Russian coat of arms. He was the first to bear the title of Tsar of Great Russia, and proclaimed the unity and the indivisibility of the Russian dominions.—**Ivan IV** (or II), grandson of the former, was born 1530, succeeded in 1534, was crowned in 1547, died 1584. His atrocities gained him the name of *The Terrible.* Yet he did much to civilize and improve his people, introduced learned men, artists, and mechanics into Russia, and concluded a commercial treaty with England. He killed his eldest son in a fit of rage.—Cf. A. S. Rappoport, *History of Russia* (Temple Primers).

Ivangorod, a fortified town of Poland, situated at the confluence of the Wieprz with the Vistula, about 60 miles south-east of Warsaw. The fortress of Ivangorod became prominent during the European War. It was attacked by Hindenburg in Oct., 1914, but the German attempt to capture the fortress during their first drive on Warsaw failed completely. Ivangorod was again attacked by the Austrians under Woyrsch in July, 1915. Defeated by the Austro-Hungarian troops under Kövess on 2nd Aug., 1915, the Russians evacuated the town on 4th Aug., and it was entered by Austrians on the following day.

Ivano′vo Voznesensk, a town of Russia, government of Vladimir, an important centre of the Russian cotton manufacture. Pop. 163,726.

Iviça (ē′vi-sȧ; ancient **Ebŭsus**), an island of the Mediterranean belonging to Spain, 52 miles from Majorca, one of the Balearic Islands; area, 230 sq. miles; pop. 24,600. It is fertile, producing corn, wine, oil, fruit, &c. Salt forms, with fish and wood, the chief export. The capital is of the same name, and has a good harbour. Pop. 6225.

Ivory, the hard matter composing the tusks of the elephant, and the teeth or tusks of the hippopotamus, walrus, and narwhal. Ivory is esteemed for its beautiful white or cream colour, its hardness, the fineness of its grain, and its susceptibility of a high polish. That of the African elephant is most esteemed by the manufacturer for its density and whiteness. It is used as a material for knife-handles, pianoforte keys, &c. The ivory of the hippopotamus is preferred by the dentist, being free from grain and much harder and of a purer white than that of the elephant. The shavings and saw-dust of ivory may be converted by burning into a black powder, used in painting, named *ivory black*. Ivory may be stained or dyed; a black colour is given it by a solution of a copper salt and a decoction of logwood; a green one by a solution of verdigris; other colours by various synthetic dyestuffs. The use of ivory, chiefly for ornamental purposes, was well known in early ages. Among the Greeks it was employed for statuary purposes, &c. The medium weight of an elephant's tusk is 60 lb., but some are found weighing 170. Ivory is an important article of African trade, and the number of elephants annually killed must be great; indeed, the extermination of this noble animal is only a question of time. Substitutes are afforded by bone, celluloid, *vegetable ivory* from the hard seeds of a South American palm (Phytelephas), and by *Galaleth*, prepared from the casein of milk.

Ivory Coast (Côte d'Ivoire), a French colony constituting a part of French West Africa, and administered by a Lieutenant-Governor, who is under the authority of the Governor-General of West Africa. The colony is bounded west by Liberia and French Guinea, and east by the British colony of Gold Coast, north by the French colony of Upper Senegal and Niger, and south by the Gulf of Guinea. Its area is about 121,976 sq. miles, and its population about 1,408,000 (of whom over 1000 are Europeans). The coastal strip contains a number of lagoons which are navigable. On the borders of Liberia is a chain of hills, culminating in Mount Nimba (over 6000 feet). The colony has vast and dense forests. The chief ports are: Grand Bassam, Assinie, Grand Lahou, Sassandra, and Tabou (with a wireless station). Other important centres in the interior are: Abidjan, Dimbokro, Bouaké, and Korhogo. Maize, rice, and pineapples are cultivated by the natives, and coffee and cocoa trees by the Europeans. The colony exports palm-kernels, palm-oil, coffee, cocoa, rubber, and mahogany; its imports consist chiefly of tobacco, wines, and cotton goods. The population consists of the Agnis, who are allied ethnographically to the Ashantis and are fetishists; the Mande group, comprising the Dioula and Senonfo, the former Mahommedans and the latter fetishists; and the Krumen, who are fetishists. There are about 4000 Protestants and 3000 Roman Catholics. The Ivory Coast was occupied by the French in 1842, but the French possession really dates from 1889, and French authority became paramount in 1893. Bingerville, named after Captain Binger, who explored the interior of the country between 1883 and 1889, is the capital and seat of administration. Abidjan is an important inland place. A railway has been constructed from this place to Bouaké, and is to be lengthened to the north. The Budget of the colony for 1920 was 12,325,700 francs.

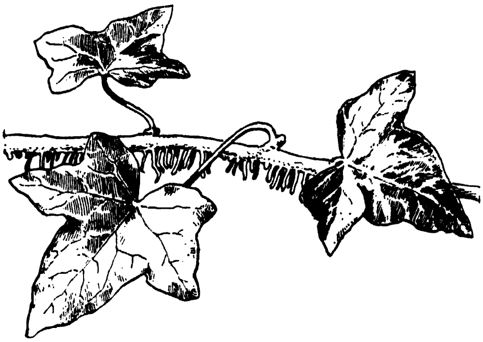
Ivory-palm (*Phytelĕphas macrocarpa*), a low-growing palm, native of the warmer parts of South America. It has a creeping caudex or trunk, terminal pinnatifid leaves of immense size, male and female flowers on different plants, and fruit in the form of a cluster of drupes, weighing about 25 lb. when ripe. Each drupe contains six to nine seeds, each as large as a hen's egg, the albumen of which when ripe is close-grained and very hard, resembling the finest ivory in texture and colour. It is therefore often wrought into buttons, knobs for doors or drawers, umbrella handles, and other articles, and is called *Vegetable Ivory*. The seeds are also known as *Corozo-nuts*, and are imported in considerable quantities.

Ivrea (iv-rā′ȧ; the ancient **Eporedia**), a town of North Italy, province of Turin, picturesquely situated on the Dora Baltea, with a cathedral, said to have been founded in the fifth century on the site of a heathen temple. Pop. 11,330.

Ivry-la-Bataille (iv-rē-lȧ-bȧ-tā-yė), a village in France, 40 miles west of Paris, where a battle was gained by Henry IV in 1590 over the forces of the League. Pop. 1190.

Ivry-sur-Seine (iv-rē-sür-sen), a suburb of Paris, on the Seine, 4 miles S.S.E. of the capital. It has a fine church, the remains of an old castle, asylum for lunatics, various manufactures, and extensive wine-cellars hewn out of the rock. Pop. 35,445.

Ivy, a climbing plant of the genus Hedera (*H. Helix*), nat. ord. Araliaceæ. The leaves are smooth and shining, varying much in form, from oval entire to three and five lobed; and their perpetual verdure gives the plant a beautiful appearance. The flowers are greenish and inconspicuous, disposed in globose umbels, and are succeeded by deep green or almost blackish berries. *H. Helix* (the common ivy) is found throughout almost the whole of Europe, and in many parts of Asia and Africa. It is plentiful in Britain, growing in hedges, woods, on old buildings, rocks, and trunks of trees. A variety, called the Irish ivy, is much cultivated on account of the large size of its foliage and its very rapid growth. The ivy attains a great age, and ultimately becomes several inches thick and capable of supporting its own stem. The wood is soft and porous, and when cut into very thin plates may be used for filtering liquids. In Switzerland and the south of Europe it is employed in making various useful articles. The ivy has been celebrated from remote antiquity, and was held sacred in some countries, as Greece and Egypt. Its medicinal properties are unimportant. Chinese ivy (*Parechites Thunbergii*) is a climbing shrub with privet-like leaves and sweet-scented flowers.



Stem of Ivy, showing rootlets

Ixi′on, in Greek mythology, king of the Lapithæ in Thessaly. He married Dia, the daughter of Deioneus, and caused the death of his father-in-law. He prayed for forgiveness to Zeus, who pardoned him and invited him to his table. Ixion then sought to seduce Hera, and for his wickedness he was punished in the infernal regions by being tied to a perpetually revolving fiery wheel.

J

J, the tenth letter in the English alphabet, and the seventh consonant. The sound of this letter coincides exactly with that of *g* in *genius*. It is therefore classed as a palatal, and is the voiced sound corresponding to the breathed sound *ch* (as in *church*). The sound does not occur in Old English, and was introduced through the French. As a character it was formerly used interchangeably with *i*, and the separation of these two letters in English dictionaries is of comparatively recent date.

Jabalpur (ja-bal-pōr′), or **Jubbulpore**, a town of India, capital of Jabalpur district, Central Provinces, a modern town with wide and regular streets, an important railway station and centre of trade, situated amidst rocks at an elevation of about 1500 feet above the level of the sea. It has a school of industry, in which large quantities of tents and carpets are made. Pop. 100,651.—The district has an area of 3918 sq. miles, and a pop. of 748,146.

Jab'iru (*Mycteria americana*), an American stork of white colour, with black head, neck, bill, and feet, which ranges from Texas to the Argentine.

Jablonitza Pass, in the Transylvanian Carpathians, 3300 feet above the sea-level. It was the scene of severe fighting during the European War, between Russians and Austrians in 1915 and 1916, and between Roumanians and Austro-Germans in 1916 and 1917.

Jaboran'di, a powerful drug obtained from the leaves and root of one or more plants of the genus Pilocarpus, ord. Rutaceæ, natives of Brazil. It causes a great increase of the saliva and profuse perspiration.

Jacamar' (Galbula), brilliant tropical American birds allied to toucans and woodpeckers. Their plumage is of a metallic green above and reddish beneath; the long straight beak is generally black, as are also the weak feet. They live in damp woods and feed on insects.

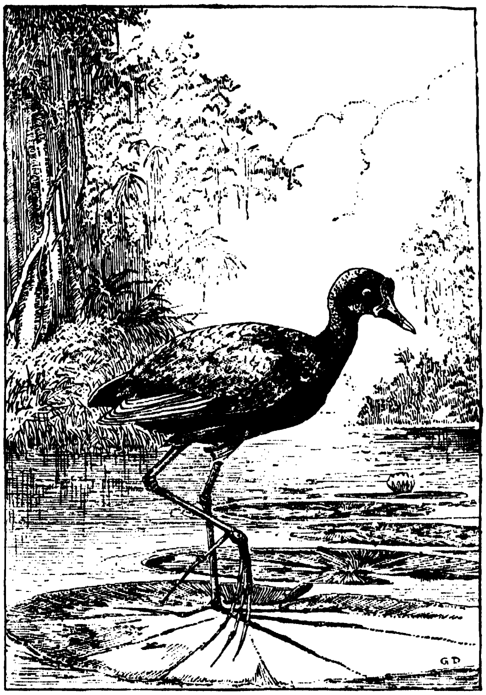
Jac'ana (Parra, &c.), the common name of birds of the family Parridæ, related to the plovers. They have long toes with very long claws, so that they can stand and walk on the leaves of aquatic plants when in search of their food, which consists of worms, small fishes, and insects. They inhabit lakes and marshes in tropical America, Africa south of the Sahara, South Asia, East Indies, New Guinea, and Australia.

Jacaran'da, a name of several South American trees, nat. ord. Leguminosæ, yielding the fancy woods known as violet-wood, king-wood, and tiger-wood. A genus of Brazilian trees is also called *Jacaranda*, and some species of it yield rose-wood. It belongs to the nat. ord. Bignoniaceæ.

Jacare, an American crocodile of the genus Caiman. One species (*C. sclerops*) ranges from South Mexico to the Northern Argentine; two are native to Guiana; and two live in the Upper Amazon, one of these (*C. niger*) attaining the length of 20 feet.

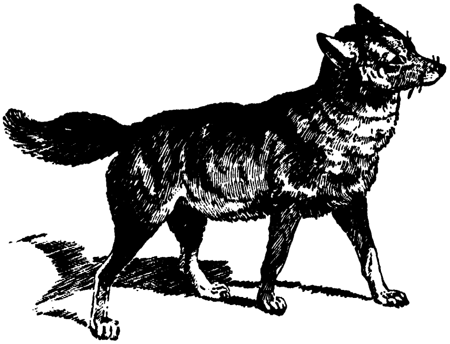
Jack, from Fr. *Jacques*, James, which, being a very common personal name in France, came to stand for any common fellow or menial, and was substituted for the equally common English name John. Hence its application in such terms as *boot-jack*, *smoke-jack*, *roasting-jack*, &c., and also in several senses alone. Thus a *jack* is an apparatus for raising great weights by the application of strong screws. The flag called a *jack* is strictly one displayed from a jackstaff on the end of a bowsprit, but is now loosely used as in *Union Jack*. Taken nautically the term is applied to a bar of iron athwartships at a top-gallant masthead, to support a royal mast and spread the royal shrouds.

Jack, or **Jaca** (*Artocarpus integrifolia*), a tree of the bread-fruit genus, a native of India. The fruit, which springs from the old wood, grows to a larger size than the bread-fruit, often weighing more than 30 lb.; but it is neither so palatable nor so nutritious. It forms a great part of the food of the natives in some parts of India, Ceylon, &c. The timber is of a yellowish colour, and is used for many purposes.



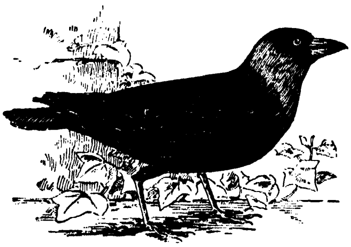
Brazilian Jacana (*Parra nigra*)

Jac'kal, one of several species of the dog genus (Canis), native to Asia and Africa, and resembling small wolves in appearance. The general colour is a dirty yellow. Jackals are gregarious, hunting in packs, rarely attacking the larger quadrupeds. They feed chiefly on carrion, and are nocturnal in habits. Jackals interbreed with the common dog, and may be domesticated. One species (*C. aureus*) is common in India; and of the four African species one is the black-backed jackal (*C. mesomĕlas*), and another (*C. adustus* or *lateralis*), distinguished by a dark side-stripe and a penetrating bark.



Slender Jackal (*Canis anthus*)

Jackdaw (*Corvus monedŭla*), a common British bird of the crow family, smaller than the rook, having a comparatively short bill and whitish eyes; hinder part of the head and neck of a greyish colour, back and wings glossy black. The average length is about 12 inches. The nests are built in towers, spires, or like elevated situations, hollow trees, and holes in cliffs. The eggs, from five to six, are of a greenish colour. Its food consists of worms, insects, and larvæ. Like their neighbours the rooks, they are gregarious. They are readily domesticated, and may be taught to pronounce words distinctly. Like the magpies, they have attained a notoriety for thieving.



Jackdaw (*Corvus monedŭla*)

Jackson, Andrew, seventh President of the United States from 1829 to 1837, was born in South Carolina 15th March, 1767, died 8th June, 1845. His father, who was of Scottish descent, had died before his son's birth. In his fourteenth year, on the outbreak of the American Revolution, he joined a regiment of volunteers to fight in the cause of independence. After losing two brothers in the struggle, he retired from military service and devoted himself to law. He became a judge of the Supreme Court, representative of Tennessee in Congress, and Senator. When, in 1812, war was declared against England, he was made major-general of the Tennessee militia. In 1813 he defeated the Creek Indians, who were wasting the country with fire and sword, and made himself master of Pensacola. While engaged in the defence of New Orleans, he established his military reputation by his repulse of the British there in 1815. His arbitrary proceedings, however, incurred general censure, and he was condemned to pay a heavy fine. From 1817 to 1818 he was employed against the Seminole Indians, but again acquired a reputation for excessive severity. In 1828 and again in 1832 he was elected President, and the eight years during which he held this office were marked by the rapid extension of democratic tendencies. In 1837 he retired to his estate in Tennessee, and there he died.—Cf. T. E. Watson, *Life and Times of Andrew Jackson.*

Jackson, Frederick George, British Arctic explorer, born in 1860. Educated at Edinburgh University, he travelled in the Australian deserts, and in 1893 made a sledge journey of about 3000 miles across the Siberian tundra and Lapland in midwinter. In 1894 he commanded the expedition sent out by Lord Northcliffe (then Alfred Harmsworth) to explore Franz-Josef Land.

Jackson, Henry, regius professor of Greek at Cambridge 1906–21, was born in 1839, and died in Sept., 1921. He was educated at Cheltenham College and at Trinity College, Cambridge, where he graduated as third in the Classical Tripos of 1862, the year in which Jebb was senior classic. He became assistant tutor of his college in 1866, and was prælector in ancient philosophy from 1875 to 1906, when he succeeded Jebb in the Greek chair. He was awarded the Order of Merit in 1908, and received honorary degrees from the Universities of St. Andrews, Aberdeen, Glasgow, Oxford, Manchester, and Sheffield. While he was a profound scholar in every branch of classical learning, Professor Jackson made a special study of Greek philosophy, and wrote many papers in the *Journal of Philology* and elsewhere on philosophical subjects. He edited the Fifth Book of Aristotle's *Ethics*, and published, in conjunction with R. C. Jebb and W. E. Currey, a collection of *Translations.* He was a keen Dickensian, and in 1911 discussed the problems connected with Dickens's unfinished novel in a small book entitled *About Edwin Drood.*

Jackson, Thomas Jonathan, better known as *Stonewall Jackson,* an American general, born in 1824 in Virginia, died 9th May, 1863. In 1842 he entered the military academy at West Point as cadet. Four years later he received a second-lieutenant's commission, and was engaged in the Mexican War, and for his gallantry was made a captain, and afterwards raised to the rank of major. In 1852 he resigned his commission, and was appointed professor of mathematics and artillery tactics in the military institute at Lexington, Virginia. On the outbreak of the Civil War in 1861 he entered the Southern army with the rank of brigadier-general. He commanded the reserve at Bull's Run, and acquired his cognomen of 'Stonewall' by the firmness of his troops and his own coolness in the heat of action. By the end of the year he was made major-general. In June, 1862, he was defeated by General Banks at Cross Keys, but made a masterly retreat. In August, 1862, he won the second battle of Bull's Run, and captured Harper's Ferry in September. In the same month he supported Lee at Antietam, and again at Fredericksburg in December. In 1863 he took a prominent part in the battle of Chancellorsville. On the evening of the battle he died of wounds inadvertently received from his own men. He was a man of indomitable energy and deep religious feeling.—BIBLIOGRAPHY: H. A. White, *Stonewall Jackson*; J. E. Cooke, *Stonewall Jackson: a Military Biography*.

Jackson, a city of Michigan, United States, 76 miles west of Detroit, an important railway centre, with coal-mines, foundries, engine-works, various manufactures, and the State prison. It was settled in 1829, and became a city in 1857. Pop. (1920), 48,374.

Jackson, a town of Tennessee, United States, with a Baptist university and trade in cotton. It was settled in 1819, and became a city in 1854. Pop. (1920), 18,860.

Jackson, the capital of Mississippi, United States, on the Pearl River, 45 miles east of Vicksburg, with a handsome State house. It was settled in 1830, and became a city in 1840. Pop. 21,262.

Jacksonville, a town of Illinois, United States, on a fertile prairie, near a small affluent of the Illinois River. It has some handsome public buildings, and various educational and charitable institutions, including the Illinois College, and State asylums for the blind, insane, and deaf and dumb. It was settled in 1825, and became a city in 1867. Pop. (1920), 15,713.

Jacksonville, a town of Florida, United States, the principal port on the River St. John, 25 miles from its mouth, with an active steamboat traffic and a large trade in lumber and cotton. Pop. (1920), 91,558.

Jack the Ripper, the name given to an unknown criminal who perpetrated a series of brutal murders on unfortunate women in the East End of London between Dec., 1887, and July, 1889. Most of the women were mutilated in such a way that the authorities were of opinion that the murderer was probably a sexual maniac. Jack the Ripper was never caught or even identified by the police.

Jacob, the son of Isaac, and the grandson of Abraham, the last of the Jewish patriarchs, and the true ancestor of the Jews. Having craftily obtained from the blind and infirm Isaac the blessing of the first-born in place of his brother Esau, he was obliged to flee from the anger of his brother, and took up his abode with his uncle Laban. Here he served twenty years, and obtained Leah and Rachel as his wives. On his return to Canaan he was met by an angel, with whom he wrestled all night, and having gained the victory was thereafter named *Israel*, that is, *the hero of God*. Hence the Hebrews from him are called *Israelites*. A severe blow to him in his old age was the loss of his favourite son Joseph, whose brothers had sold him to Ishmaelite merchants, and led Jacob to believe that he had been devoured by wild beasts. Joseph subsequently became the highest officer at the court of Pharaoh in Egypt, and thus was the means of bringing the whole House of his father to that country. Jacob died at the age of 147, and, according to his wish, was buried in the tomb of Abraham, before Mamre in Canaan.

Jacobi (yá-kō′bi), Friedrich Heinrich, a German philosopher, born 1743, died 1819. He first engaged in commerce, but retired from business on receiving a public appointment. He formed acquaintance with many of the most eminent literary men of the day, including Goethe, Wieland, and Herder. Afterwards he was made president of the Bavarian Academy at Munich, retiring in 1813. His views had some analogies with those of Hamilton and the Scottish school. Thought, he affirms, cannot explain facts but only connect them. The existence of objects that affect us cannot be demonstrated, but we are directly convinced of their existence in the act of perception. The knowledge of God is present to us through the heart in virtue of the divine spirit within us, which comes directly from God. His most noted works are the philosophic novels *Allwills Briefsammlung* and *Woldemar*; a work on the doctrine of Spinoza, *Briefe über die Lehre Spinozas*; and *David Hume über den Glauben, oder Idealismus und Realismus*. —Cf. Lévy-Bruhl, *La Philosophie de Jacobi*.

Jacobi, Karl Gustav Jacob, one of the great mathematicians of the nineteenth century, born at Potsdam of Jewish parents in 1804, died in 1851. He was professor at Königsberg from 1829 to 1842. After ill-health had compelled him to retire, he was granted a royal pension, and spent his last years at Berlin. His chief work was done on elliptic functions, the theory of which had been founded by Abel and Legendre, but owes more to Jacobi than to any other mathematician. The treatise, *Fundamenta nova theoriæ functionum ellipticarum* (1829), in which he develops the theory of the Theta functions, is a classic. He was a prolific writer, and left his mark on nearly all departments of mathematical analysis. The Berlin Academy published his *Gesammelte Werke* (1881–91).

Jac'obins, the most famous of the clubs of the great French Revolution. It originated as a club of Breton deputies at the meeting of the States-General at Versailles in 1789, and, when the National Assembly removed to Paris in 1790, it took up its quarters in the Dominican Convent, which was commonly known as the Jacobin Convent from its dedication to St. James. Its membership then ceased to be purely Breton and to be confined to men who sat in the Assembly, and it became the most prominent revolutionary debating society. It consisted, from the first, chiefly of advanced politicians, but so moderate a man as Mirabeau was its president in the end of 1790. About the time of the dissolution of the National Assembly (Sept., 1791) Robespierre became the leader of the Société des Amis de la Constitution (as the Jacobin Club was technically described), and, under his guidance, it exercised an illegitimate influence over the elections to the Legislative Assembly. In that body the Jacobins were in a minority, but they dominated its counsels, and the club was in some respects more important than the Assembly. It had over 1200 branches in various parts of France, all of which recognized the authority of the head-quarters in Paris, and its opinions were spread by the publication of a *Journal*. The insurrectionary movements of 20th June and 10th Aug., 1792, were largely inspired by Jacobin dissatisfaction with the existing Constitution, and the official name of the club was changed to Société des Amis de la Liberté et de l'Égalité. The Jacobins also obtained control of the Commune or municipal council of Paris which encouraged the massacres of Sept., 1792. When the Convention came into power in the autumn of 1792, the dominant section of the Jacobin Club entered into a long struggle with the more moderate section of Girondists, many of whom were members of the club but were expelled at an early stage in the conflict. To the growing Jacobin influence may be attributed, in part, the execution of Louis XVI in Jan., 1793, and in the following summer the Girondists were definitely defeated. From that time the Jacobin leader, Robespierre, had the chief power in the Committee of Public Safety, the new form of the revolutionary government, and the club and the Commune were responsible for the Reign of Terror. Robespierre's authority depended largely upon the support of the club, which took a prominent part in the contest against the attempt of Hébert and the Commune to introduce compulsory atheism, and in the establishment of the Festivals of the Supreme Being. After Robespierre's fall in July, 1794, the Jacobins were naturally regarded as his accomplices, and there was a demand for vengeance upon them as the chief agents in the Terror. The club was therefore suppressed in Dec., 1794. An unsuccessful attempt to resuscitate it was made in 1799. The word 'Jacobin' became an English term for the advocates of extreme or revolutionary views, and Canning gave the title of the *Anti-Jacobin* to his periodical satire on French republican theories. The word Jacobin has recently tended to be replaced by Bolshevik as a name for extreme revolutionaries.—Cf. F. A. Aulard, *La Société des Jacobins, Recueil de Documents.*

Jac'obites, Monophysite Christians in the East, who were united by a Syrian monk, Jacobus Bardai (578), during the reign of Justinian, into a distinct religious sect. The Jacobites, so styled from their founder, now number about 80,000, and their Church includes the three patriarchates of Antioch, Alexandria, and Armenia. Circumcision before baptism and the doctrine of the single nature of Christ (hence their name *Monophysites*) are common to them with the Copts and Abyssinians; but in other respects they deviate less than the other Monophysites from the discipline and liturgy of the orthodox Greek Church. See *Nestorians*.—Cf. F. J. Bliss, *The Religions of Modern Syria and Palestine.*

Jacobites (from the Lat. *Jacōbus*, James) was the name given at the Revolution of 1688–9 to the party which wished to replace King James II and VII on the throne. In the reign of William III they made attempts at a restoration both in Scotland and in Ireland, but the Scottish effort failed after the death of Viscount Dundee (Graham of Claverhouse) at the battle of Killiecrankie in 1689, and the Irish Jacobites were suppressed after the battle of the Boyne in 1690. During the rest of the reign of William, and throughout that of Anne, the Jacobites were content with plots and conspiracies, and their hopes were raised by the accession of the Tories, under Oxford and Bolingbroke, to power in the end of Anne's reign. The queen was known to have sympathy with her half-brother, the unfortunate prince who was described by the Jacobites as James III and VIII, and by others as the Chevalier de St. George or the Pretender, and Bolingbroke was corresponding with him. But the Tories were timorous and half-hearted; the queen's death took them by surprise, and they missed the best opportunity which ever occurred for the Jacobite cause. The new king, George I, was a foreigner and unpopular, and in 1715, a year after his accession, the Jacobites took the field. They had a large following in Scotland and some support in the north of England, but they were deceived in their hopes of French help, and their leader, the Earl of Mar, was incompetent. James himself did not arrive until Mar had been defeated at Sheriffmuir, near Dunblane, and the English Jacobites at Preston, in November, and he had to make his way back to France. Some years later, when the Government of George I was involved in quarrels with Spain and with Sweden, a project of a second rising failed through the death of Charles XII of Sweden, and there was only an insignificant Spanish invasion at Glenshiel (1719). When the Jacobites at last found a real leader in the person of Prince Charles Edward, the elder son of the Chevalier de St. George, their chance of success had been destroyed by the long period of peace and prosperity which the country had enjoyed under the rule of Walpole. French help again failed, and the prince landed, with only seven followers, near Arisaig in July, 1745. A large number of Highlanders flocked to his standard, and he made a march upon Edinburgh, which capitulated, and the prince defeated the Government troops under Cope at Prestonpans. An invasion of England followed, but on reaching Derby, in December, a council of war, against the wishes of the prince, decided upon a retreat in view of the almost entire lack of English support. The Jacobites won another victory at Falkirk in Jan., 1746, but were completely defeated by the Duke of Cumberland at Culloden, near Inverness, on 16th April, and the prince, after many narrow escapes, made his way to France in September. The suppression of the 'Forty-five marks an era in the history of Scotland, and especially in the history of the Highlands, which were for the first time brought under the control of the central Government. It also marks the end of the Jacobites as a political party. Although a sentimental Jacobitism continued to exist until the death of the prince's brother, the Cardinal Duke of York, in 1807, it ceased to have any actual significance, and the Tories avowed their loyalty when George III succeeded in 1760. Most of the beautiful Jacobite songs were written after Jacobitism had ceased to be a political force, and many of them were the work of Lady Nairne, a bigoted Presbyterian.—BIBLIOGRAPHY: F. W. Head, *The Fallen Stuarts*; H. M. Vaughan, *The Last of the Royal Stuarts*; James Hogg, *The Jacobite Relics of Scotland*; A. Lang, *The King over the Water*, and *Prince Charles Edward*.

Jacobsen, Jens Peter, Danish author, born at Thisted, in Jutland, 7th April, 1847, died 30th April, 1885. He studied botany at the University of Copenhagen, and became known as the translator of Darwin. In 1872 he was awarded the gold medal of the university. Jacobsen, however, was interested in letters as well as in science, and in 1872 he published his first volume of stories, entitled *Mogens*. This was followed by his historical novel *Marie Grubbe*, a study of seventeenth-century life; *Niels Lynne* (English translation under the title of *Siren Voices*), a modern novel with sceptical and realistic tendencies. What distinguishes Jacobsen's novels is the mixture of imagination, science, and philosophy. His prose style is now considered as one of the best in Denmark.

Jacob's Ladder (*Polemonium cœruleum*), a plant of the ord. Polemoniaceæ, an ornamental border-plant, of easy culture and propagation; indigenous to Central and Southern Europe, and parts of Asia and North America.

Jacquard (zhȧk-är), Joseph Marie, the inventor of the famous machine for figured weaving named after him, was born at Lyons in 1752, died in 1834. His parents were silk weavers, and he learned the same trade. After a long period of hardship, during which he shared in some of the campaigns of the Revolution, he made his name famous by the invention of his new loom, which was publicly exhibited in 1801. He endeavoured to introduce it into general use in Lyons, but was mobbed, and all but lost his life. Ultimately, however, his invention was bought by the French Government, and he was able to spend the latter part of his life in comfortable independence. The subsequent prosperity of Lyons is largely attributable to his invention, and in 1840 a statue was erected to him on the very spot where his loom was publicly destroyed.

Jacquard Loom, a name given to any ordinary kind of loom on the top of which a machine termed a ' jacquard ' is fitted. The name given to such a loom is due to the fact that Joseph Marie Jacquard invented the cylinder, and arranged this, in conjuction with existing parts of a somewhat similar pattern-producing machine, in the positions which they are used to this day. The combination of the jacquard and loom with the jacquard cards punched or perforated to form, in conjunction with the needles and hooks of the jacquard, the selecting medium of the ornament, enables all kinds of decorative fabrics to be produced in the so-called jacquard loom. Such a machine is used essentially and exclusively for the ornamentation of fabrics in which the pattern on the cloth is developed by a very large number of different ways of interweaving the weft with the warp; it may, however, be also used as a figuring device in conjunction with several different colours of warp and weft yarns, in which case the fabrics produced may be tapestries, brocades, carpets, velvets, hangings, and a host of others. Decorative fabrics such as Axminster carpets and tapestry carpets do not require a jacquard for their production. See *Weaving.*

Jacquerie (zhăk-rē), the name given to the rising of the French peasantry against their lords in the middle of the fourteenth century, after the battle of Poitiers. They committed great devastations and outrages, particularly in the north-east of France. They were at length quelled by Captal de Buch and Gaston Phébus, Count of Foix. The term *Jacquerie* is derived from *Jacques Bonhomme*, a familiar epithet for the French peasant.

Jactitation of Marriage (Lat. *jactitare*, to boast) is a false boasting of marriage. In England the injured party may bring a suit of jactitation of marriage to have the offender ordered to desist. The corresponding action in Scotland is a ' declarator of putting to silence '.

Jade, or Jahde (yä'de), a small strip of coast territory belonging to the Prussian province of Hanover, but locally in Oldenburg, at the entrance of Jade Bay. It was acquired by the Prussian Government for the purpose of constructing a naval port and shipyard, and here has grown up Wilhelmshaven.

Jade, an ornamental stone, also called nephrite, a native silicate of calcium and magnesium. It is a matted aggregate of crystals of a non-aluminous or slightly aluminous amphibole (see *Hornblende*), usually of a colour more or less green, of a resinous or oily aspect, and, when polished, hard and very tenacious. It has long been highly prized for making carved ornaments in China, New Zealand, and among the native races of Mexico and Peru. Jade celts or axes are common among uncivilized races, and prehistoric specimens have been found in Europe, though the stone itself is not found there. A similar stone, more properly called *jadeite*, is frequently confounded with jade proper. It is a silicate of aluminium and sodium. Being hard, it is used in China and elsewhere for the same purposes as jade.

Jaen (*hà*-en'), a picturesque town of Southern Spain, Andalusia, capital of the province of Jaen, 41 miles N. by W. of Granada. It is the seat of a bishop, and has an imposing cathedral in the Renaissance style, episcopal seminary. Pop. 26,894.—The province of Jaen was a Moorish kingdom till 1246, and fell under the sway of Castile. The pop. of the province is 565,000.

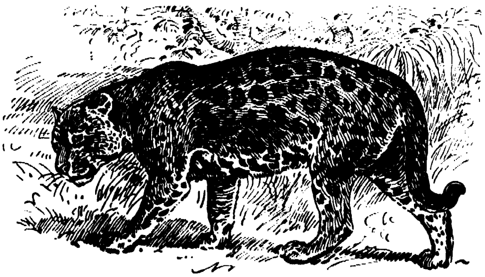
Jaffa (anciently Joppa), a seaport of Palestine, 31 miles north-west of Jerusalem, picturesquely situated upon an eminence, the port of Nablus and Jerusalem, with which latter it is now connected by railway. The town was taken by Napoleon in 1799, and during the European War it was captured by the British under Allenby on 17th Nov., 1917. It was occupied by Australian and New Zealand troops. Disturbances and encounters between Jews and Arabs took place at Jaffa in 1921. The town exports oranges (an excellent variety), soap, grain, sesame, and olive-oil. A railway line connecting Ludd with Jaffa was opened in 1920. Pop. 50,000.

Jaffna, or Jafnapatam, a town of Ceylon, at the northern extremity of the island, originally a Dutch settlement, and still thoroughly Dutch in its architecture and aspect. Most of the inhabitants are Tamils. Pop. 47,000.

Jägerndorf (yā'gėrn-dorf), or **Krnov**, a town of Czecho-Slovakia (formerly in Austria, Silesia), on the Oppa, 13 miles north-west of Troppau. It is walled, has a handsome church, a palace, and manufactures of woollens. Pop. 14,675.

Jagow, Gottlieb von, German statesman, born 22nd June, 1863. Educated at the University of Bonn, he was in the diplomatic service and became Ambassador at Rome in 1909, retaining his post until 1913. He was subsequently appointed Secretary of State for Foreign Affairs, but retired in Nov., 1916, when Germany's peace offer to the Allies had failed. He published *Causes of the World War.*

Jaguar (ja-gwär'), *Felis onca*, the American tiger, an arboreal carnivorous mammal of South and Central America, sometimes equalling a leopard in size, of a yellowish or fawn colour, marked with large dark spots and rings, the latter with a dark spot in the centre of each. It rarely attacks man unless hard pressed by hunger or driven to bay. The skin is valuable, and the animal is hunted by the South Americans in various ways.



Jaguar (*Felis onca*)

Jainas, or Jains, a Hindu religious sect which, from the wealth and influence of its members, forms an important division of the Indian population. The sect was very numerous and important in the eighth and ninth centuries of the Christian era, and they have left many monuments of their skill and power in the fine temples built in different parts of the country. Jainism, like Buddhism, denies the authority of the Veda, and is therefore heretical, according to the Brahmans. It goes back to those early currents of Indian religious speculations which gave rise to the Indian philosophies and to Buddhism. Jainism is not an offshoot of Buddhism, and although it has many doctrines in common with Buddhism, it is distinguished from the latter by its recognition of a divine personal ruler of all, and by its political leanings towards Brahmanism. The Jains reverence certain holy mortals, who have acquired by self-denial and mortification a station superior to that of the gods; and they manifest extreme tenderness for animal life.—Cf. H. L. Jhaveri, *The First Principles of the Jain Philosophy.*

Jaipur (jī-pör′), or **Jeypore**, a state in Rajputána, Hindustan, governed by a maharajah, under the political superintendence of the Jeypore Residency; area, about 15,579 sq. miles. The soil, except in the south-east, is mostly sandy; the surface of the country is diversified by hill ranges. Corn, cotton, tobacco, opium, and sugar-cane are extensively raised. There are manufactures of enamel work on gold and of woollen cloth. Pop. 2,636,640.

Jaipur, capital of the above state, one of the finest of modern Hindu cities, has regular streets, with large, handsome houses. It was founded in 1728. There is a college, a school of arts, an industrial museum, a hospital, fine gardens, and several beautiful temples. Pop. 137,100.

Jaisalmer (jī-s*a*l-mär′), or **Jeysulmeer**, a state of India, in Rajputána, under the political superintendence of the Western States Agency; area, 16,062 sq. miles. It is mostly a sandy desert with sparsely scattered villages. Water is scarce, the wells going down to a depth of 490 feet. The climate is healthy. Pop. (reduced by famine), 88,311.

Jaisalmer, the capital of the above state, is situated on a rocky ridge. The palace, the Jain temples in the fort, and the houses of the wealthy are remarkable for exquisite stone-carving. Pop. 11,000.

Jajpur, or **Jajpore**, a town of Hindustan, on the Baitarani, in Cuttack district, Bengal. It is considered sacred by the Brahmans, who celebrate an annual fair in honour of the ‘ Goddess of the Waters ’ of Hindu mythology. Pop. 11,283.

Jalal′pur, a town of Hindustan, in Gujerat district, Punjab, with a Government school, and shawl manufactures. Pop. 11,000.

Jalandhar (j*a*l-*a*n-dh*a*r′), or **Jullundur**, a town of Hindustan, head-quarters of district of same name, in the Punjab; with a good trade, military cantonment, excellent American Presbyterian mission school, &c. Pop. 69,318.—The district, a fertile tract between the Sutlej and the Beas, has an area of 1433 sq. miles, and a pop. of 918,000.

Jalap, *Ipomœa Purga*, a Convolvulaceous climber of the Mexican Andes. The tuberous roots contain two glucosidal resins, jalapine and scammonine; the latter also occurs in scammony (*Convolvulus Scammonia*) and in *Ipomœa orizabensis*, both of which are drastic purgatives.

Jalapa, or **Xalapa** (*h*ȧ-lä′pȧ), a city, Mexico, capital of the state of Vera Cruz. It is the residence of the wealthiest merchants of Vera Cruz, and enjoys a fine climate. The *jalap* root is found abundantly there. Pop. 24,816.

Jala′un, a town in a district of the same name in the United Provinces of India, 110 miles S.E. of Agra, in a swampy and unhealthy locality. Pop. 8300.—The district consists of a plain west of the Jumna; area, 1469 sq. miles; pop. 405,000.

Jalisco (*h*ȧ-lis′kō), or **Guadalajara**, a state of the Republic of Mexico, bounded on the west by the Pacific. It is chiefly mountainous, but well watered and wooded, and the climate is healthy. The soil is fertile, and wheat and barley are abundantly produced. The capital is Guadalajara. Pop. 1,208,855.

Jalpaiguri (j*a*l-pī-gu̦-rē′), a town of Hindustan, head-quarters of district of same name, in Bengal, on the Teesta; pop. 11,500.—The district lies south of Bhutan and north of Kuch Behar; area, 2920 sq. miles; pop. 902,000.

Jamaica, one of the West India Islands, 80 or 90 miles S. of Cuba, the third in extent, and the most valuable of those belonging to the British; 146 miles in length east to west, and 49 miles broad at the widest part; area, 4207 sq. miles. It is divided politically into three counties—Cornwall, Middlesex, and Surrey; its capital is Kingston. The island as a whole is very beautiful, and much of it is fertile. The coast is indented with a number of good harbours, of which Port Royal or the harbour of Kingston is the most considerable. The interior is traversed by lofty mountains in all directions, the principal chain, called the Blue Mountains, reaching the height of 7270 feet. The declivities are steep, and covered with stately forests. Jamaica is well watered, having numerous rivers and springs. Earthquakes of a violent character have been frequent. The climate in the districts along the coast is, in most places, exceedingly hot, but is not on the whole unhealthy; on the high lands the air is temperate and pure, while even on the low grounds the heat is greatly moderated by the cool sea-breezes which set in every morning. There are two rainy and two dry seasons. Among the indigenous forest trees are mahogany, lignumvitæ, iron-wood, logwood, braziletto, &c. The native fruits are numerous, and many of them delicious; they include the plantain, guava, custard-apple, pineapple, sour-sop, sweet-sop, papaw, and cashew-apple. The orange, lime, lemon, mango, grape, bread-fruit tree, and cinnamon tree have all been naturalized in the island. The chief cultivated vegetable products are sugar, coffee, maize, pimento, bananas and other fruits, ginger, and arrow-root. The cinchona tree has been introduced, and is spreading. Of wild animals only the agouti and monkey are numerous. Domestic fowls thrive well, and cattle-raising is profitable. Fish abound in the sea and rivers. The exports and imports for 1919–20 had a value of £5,627,328 and £5,085,615 respectively. Fruit, sugar, rum, coffee, dyewoods, and pimento are the chief of the former, and clothing and other manufactured goods of the latter. The government is vested in the Governor, assisted by a Privy-Council, and a Legislative Council composed of twenty-nine members, fourteen elected, ten nominated, and five *ex officio*; women were enfranchised in 1919. The revenue amounts to over £1,000,000 annually; the public debt is £3,772,257, the greater part of it having been expended on railways, roads, harbours, and other public works. Spanish Town and Kingston are united by railway, and the total number of miles open for traffic is about 200. The English Church is presided over by a bishop, assisted by a regular staff of parochial clergy. The Baptists, Methodists, Presbyterians, and other Protestant bodies are well represented, and there is a considerable number of Roman Catholics and Jews. Education is rapidly extending; but the general state of morality seems to be low. The population in 1911 was 831,383. The estimated pop. in 1920 was 893,580.

Jamaica was discovered by Columbus in 1494, in his second expedition to the New World. In half a century the cruelty of the Spanish conquerors exterminated the natives. It was taken by Cromwell in 1655, and ceded to England by the Treaty of Madrid in 1670. After the abolition of slavery the prosperity of Jamaica greatly decreased, and this led to the importation of coolies to work on the estates. In 1865 a serious revolt broke out among the negroes at Morant Bay, and was put down with considerable severity by Governor Eyre. After that disaffection disappeared, and prosperity has much increased. But a cyclone in 1903 caused immense damage, and an earthquake in 1907 overthrew Kingston, and resulted in the loss of more than 1000 lives. A disastrous cyclone visited the western part of the island in Nov., 1912. The Cayman Islands, and the Turks and Caicos are connected with Jamaica.—Bibliography: W. J. Gardner, *History of Jamaica*; H. G. de Lisser, *Twentieth Century Jamaica*; W. P. Livingstone, *Black Jamaica: a Study in Evolution*; W. Jekyll, *Jamaican Song and Story*; J. Henderson, *Jamaica.*

Jamalpur (ja-mäl-pör′), a town of Hindustan, in Monghyr district, Bengal, with large workshops belonging to the East India Railway Company. Pop. 20,000.—Also a town in Maimansingh district, Bengal, on the Brahmaputra. Pop. 15,350.

Jambusar′, a town of British India, Broach district, Bombay Presidency, 27 miles northwest of Broach. Pop. 12,100.

James, St., called the *Greater*, the son of Zebedee and the brother of John the Evangelist. Christ gave the brothers the name of Boanerges, or *sons of thunder*. They witnessed the transfiguration, the restoration to life of Jairus's daughter, the agony in the garden of Gethsemane, and the ascension. St. James was the first of the Apostles to suffer martyrdom, having been slain by Herod Agrippa A.D. 44. There is a tradition that he went to Spain, of which country he is the tutelary saint.

James, St., called the *Less*, the brother or cousin of our Lord, who appeared to him in particular after His resurrection. He is called in Scripture the *Just*, and is probably the Apostle described as the son of Alphæus. He was the first bishop of Jerusalem, and in the first apostolic council spoke against those wishing to make the law of Moses binding upon Christians. The progress of Christianity under him alarmed the Jews, and he was put to death by Ananias, the high-priest, about A.D. 62. He was the author of the epistle which bears his name.

James I of Scotland, one of the Stewart kings, born in 1394, was the son of Robert III by Annabella Drummond. In 1406 his father wished him to be conveyed to France in order that he might escape the intrigues of his uncle, the first Duke of Albany; but the vessel in which he was being conveyed was taken by an English squadron, and the prince was carried prisoner to London. Here he received an excellent education from Henry IV, and, to relieve the tedium of captivity, he applied himself to those poetical and literary pursuits in which he so highly distinguished himself. Robert III died in 1406, but James was not allowed to return to his kingdom till 1424. Before his departure he married Joanna Beaufort, daughter of the Earl of Somerset, a lady of the blood royal of England. On his return to Scotland he caused the second Duke of Albany and his son Murdoch to be executed as traitors, and proceeded to carry on vigorous reforms, and, above all, to improve his revenue and curb the ambition and lawlessness of the nobles. The nobility, exasperated by the decline of their power, formed a plot against his life, and assassinated him at Perth in 1437. His poem *The King's Quair* (or Book) entitles him to high rank among the followers of Chaucer. Two humorous sketches of mediæval social life in Scotland, *Christ's Kirk on the Green* and *Peblis to the Play*, used to be attributed to him, but on insufficient grounds.—Cf. Andrew Lang, *History of Scotland.*

James II, King of Scotland, son of James I, born in 1430, and was thus when his father was assassinated in 1437 under seven years of age. During the minority his kingdom was distracted by struggles for power between his tutors Livingston and Crichton and the great House of Douglas. In 1449 he married Mary of Guelderland. James found the royal power menaced by the great family of Douglas, and he invited the eighth Earl of Douglas to Stirling Castle, to persuade him to abandon a league of nobles which had been formed in opposition to the Crown. The interview ended in the king fatally wounding his guest (Feb., 1452). The murder led, three years later, to the conquest and forfeiture of the Douglas territories. James met his death in Aug., 1460, by the bursting of a cannon at the siege of Roxburgh Castle, which he was trying to recover from the English.—Cf. Andrew Lang, *History of Scotland.*

James III, King of Scotland, son of James II, was born in 1451. The kingdom during his minority was governed in turn by Bishop Kennedy and the Boyd family. James throughout his reign was much under the influence of favourites, and he quarrelled with his brother, the Duke of Albany, who obtained English aid and invaded Scotland. When James marched to meet him, the nobles seized and hanged some of his favourites, including Cochrane, an architect, who was specially unpopular. Albany was restored but soon afterwards expelled, and James continued to be on bad terms with his nobles, and was murdered in 1488 after a battle at Sauchieburn, near Stirling, fought against his rebellious lords. By his marriage, in 1469, with Margaret of Denmark he brought Orkney and Shetland into the Kingdom of Scotland.

James IV, King of Scotland, born 1473, son of James III, was in his sixteenth year when he succeeded to the throne, and was, either voluntarily or by compulsion, on the side of the nobles who rebelled against his father. During his reign the ancient enmity between the king and the nobility seems to have ceased. His frankness, bravery, skill in manly exercises, and handsome person won the people's hearts, and he ruled with vigour, administered justice with impartiality, and passed excellent laws. Henry VII, then King of England, tried to obtain a union with Scotland by politic measures, and in 1503 James married his daughter, Margaret. A period of peace and prosperity followed. French influence, however, and the discourtesy of Henry VIII in retaining the jewels of his sister and in encouraging the border chieftains hostile to Scotland, led to angry negotiations, which ended in war. James invaded England with a large force, and himself and many of his nobles perished at Flodden Field in 1513.

James V of Scotland, born in 1512, succeeded in 1513, at the death of his father, James IV, when only eighteen months old. His cousin, the Duke of Albany, a Frenchman by birth and education, was the regent during his childhood, and, owing to Albany's incompetence and the intrigues of the queen-mother, Margaret of England, the period of his long minority was one of lawlessness and gross misgovernment. James assumed the reins of government in his seventeenth year. He married Magdalen, daughter of Francis I of France, and on her death Mary of Lorraine, daughter of the Duke of Guise. Henry VIII, having broken with Rome, and eager to gain over his nephew to his views, proposed an interview at York; but James never came, and it is known that Henry hoped to kidnap him. A rupture took place between the two kingdoms, but James was ill supported by his nobles, and the disgraceful rout of his troops at Solway Moss broke his heart. He died in 1542, seven days after the birth of his unfortunate daughter Mary.

James I of England and VI of Scotland, the only son of Mary, Queen of Scotland, by her cousin Henry, Lord Darnley, was born at Edinburgh Castle in 1566. In 1567 (his mother being forced to resign the crown) he was crowned at Stirling, and his childhood was passed under the direction of the Earl of Mar, and the tuition of the famous Buchanan. He had much trouble with his nobles, a party of whom made him captive at Ruthven Castle in 1582; but a counter party soon set him at liberty. These disputes were connected with the ecclesiastical controversies of this period, James, from his youth onwards, being determined to destroy the power of the Presbyterian clergy. When his mother's life was in danger, he exerted himself to some extent in her behalf (1587); but her execution took place, and he did not venture upon war. In 1589 he married Princess Anne of Denmark. In 1603 he succeeded to the crown of England, on the death of Elizabeth, and proceeded to London. One of the early events of his reign was the Gunpowder Plot (q.v.). He soon allowed his lofty notions of divine right to become known, got into trouble with Parliament, and afterwards endeavoured to rule as an absolute monarch, levying taxes and demanding loans in an arbitrary manner. Between 1606 and 1610 he succeeded in establishing Episcopacy in Scotland. In 1613 his daughter Elizabeth was married to the Elector Palatine, an alliance which ultimately brought the present royal family to the throne. He wished to marry his son Charles, Prince of Wales, to a Spanish princess, but this project failed, and war was declared against Spain. The king, however, died soon after in 1625. James, though possessed of good abilities and a good heart, had many defects as a ruler, prominent among them being subservience to unworthy favourites and disregard for the kingly dignity. He was also vain, pedantic, and gross in his tastes and habits. His name is sullied by the part he played in bringing Raleigh to the block. In his reign the authorized translation of the Bible was executed.—BIBLIOGRAPHY: S. R. Gardiner, *History of England*; J. H. Burton, *History of Scotland*; T. F. Henderson, *James I and VI.*

James II of England and VII of Scotland, second son of Charles I and of Henrietta Maria of France, was born in 1633, and immediately created Duke of York. During the Civil War he escaped from England and served with distinction in the French army under Turenne, and in the Spanish army under Condé. At the Restoration in 1660 he got the command of the fleet as Lord High-Admiral. He had previously married Anne, daughter of Chancellor Hyde, afterwards Lord Clarendon. In 1671 she died, leaving two daughters, Mary and Anne, both of whom were subsequently sovereigns of England and Scotland. Having openly avowed the Roman Catholic faith, on the Test Act being passed to prevent Roman Catholics from holding public employments he was obliged to resign his command. He was afterwards sent to Scotland as Lord High Commissioner, where he persecuted the Covenanters. He succeeded his brother as king in 1685, and at once set himself to attain absolute power. A rebellion headed by the Duke of Monmouth (his nephew) was easily put down, and this encouraged the king in his arbitrary measures. He even accepted a pension from Louis XIV that he might more readily effect his purposes, especially that of restoring the Roman Catholic religion. The result of this course of action was the Revolution of 1688 (see *England*), which immediately followed the birth of a male heir by the king's second wife, Mary of Modena. When his son-in-law, William of Orange, landed in Nov., 1688, James found himself completely deserted and fled to France, where he was received with great kindness and hospitality by Louis XIV. Assisted by Louis, he was enabled in 1689 to attempt the recovery of Ireland; but the battle of the Boyne, fought in 1690, compelled him to return to France. All succeeding projects for his restoration proved equally abortive, and he spent the last years of his life in ascetic devotion. He died at St. Germain in 1701.—BIBLIOGRAPHY: Lord Acton, *Lectures on Modern History*; Allan Fea, *James II and his Wives.*

James III, the Pretender. See *Stewart, James Edward Francis.*

James, George Payne Rainsford, English novelist, born in London in 1801, died in 1860. While still very young he produced, in 1822, a *Life of Edward the Black Prince.* Some years afterwards he composed his first novel, *Richelieu*, which was shown in manuscript to Sir Walter Scott, and published in 1829. Its success determined him towards fiction, and a series of novels, above sixty in number, followed from his pen in rapid succession, besides several historical and other works. Among them may be mentioned: *Darnley, De L'Orme, Philip Augustus, Henry Masterton, Mary of Burgundy, The Gipsy, History of Chivalry,* and a *Life of Charlemagne.* Subsequently he accepted the office of British Consul, first at Richmond, Virginia, and afterwards at Venice, where he died.

James, Henry, American novelist and essayist, a younger brother of William James, was born in New York 1843, died in 1916. He lived much on the European continent and in England. Destined for a legal career, he soon turned his attention to literature, and his novels and tales, which depend for their interest on the portrayal of character rather than on incident, are numerous. Among them are: *Daisy Miller, A Passionate Pilgrim, Roderick Hudson, The Portrait of a Lady, Tales of Three Cities, The Bostonians, Princess Casamassima, The Reverberator, The Tragic Muse, The Other House, The Spoils of Poynton, What Maisie Knew, The Wings of a Dove, The Golden Bowl, Julia Bride,* and *The Outcry.* He also wrote the *Life of Hawthorne* in the English Men of Letters Series, *French Poets and Novelists*, &c. Henry James became a naturalized British subject in 1915, and received the O.M. in 1916, shortly before his death.—Cf. F. M. Hueffer, *Henry James; a critical Study.*

James, Henry, Lord James of Hereford, English statesman, born at Hereford in 1828, died in 1911. He was educated at Cheltenham College, called to the Bar in 1852, and became Queen's Counsel in 1869. He was Liberal member of Parliament for Taunton from 1869 to 1885, being returned for Bury in the latter year. In 1873 he was appointed Solicitor-General by Gladstone, and in the same year gained the office of Attorney-General, with a knighthood; in 1880, when Gladstone returned to power, he was again made Attorney-General. When, in 1886, Gladstone offered him the post of Lord Chancellor, he declined office owing to his views on Home Rule, being from that time a Liberal Unionist. He was counsel for *The Times* in the great Parnell case. In 1895 he was created a peer as Baron James of Hereford, and was appointed Chancellor of the Duchy of Lancaster in the Unionist ministry. This latter post he resigned in 1902. The title became extinct on his death.

James, William, American psychologist and philosopher, born in New York 11th Jan., 1842, brother of Henry James, the novelist, died 26th Aug., 1910. Educated in private schools, he studied at the Lawrence Scientific School, and graduated from Harvard Medical School in 1870. In 1872 he started to teach at Harvard, and in 1881 was appointed professor, occupying at first the chair of anatomy and physiology, and afterwards those of psychology and philosophy. He was Ingersoll lecturer at Harvard University (1898), Gifford lecturer at Edinburgh (1899–1901), and Hibbert lecturer at Manchester College, Oxford (1909). What distinguished James, characterized his writings, and made his influence and reputation so great was not only his keenness and originality, and his subtle reasoning power, but the freshness of his style and the lucid exposition of his theories. If not entirely the originator, James was the foremost exponent of the doctrines of radical empiricism and pragmatism (q.v.). In the field of analytical psychology James's achievements were considerable. His works include: *Principles of Psychology* (1890), *The Will to Believe* (1897), *Human Immortality* (1898), *The Varieties of Religious Experience* (1902), *Pragmatism* (1907), *The Meaning of Truth* (1909), *Some Problems of Philosophy* (1911), and *Essays in Radical Empiricism* (1912).—BIBLIOGRAPHY: H. V. Knox, *The Philosophy of William James*; E. Boutroux, *William James*.

Jameson, Sir Leander Starr, South African politician, was born at Edinburgh in 1853, died in 1917. He studied medicine at University College Hospital, London, and took his M.D. degree in 1877. In 1878 he went to South Africa, settling in practice at Kimberley. He came into close touch with Cecil Rhodes, and in 1889 joined the pioneer expedition to Matabeleland under the auspices of the South Africa Company. In 1891 he was appointed Administrator of Rhodesia, and visiting England in 1894 was made a C.B. Having returned to Africa, on 29th Dec., 1895, with the connivance of Cecil Rhodes he started out from Mafeking with a body of troopers, and made his famous raid into the Transvaal, his purpose being to support a rising of the Uitlanders in Johannesburg. He met a strong Boer force at Krugersdorp, and was forced to surrender on 2nd Jan., 1896, the expected support from Johannesburg not being forthcoming. After being sentenced to be shot at Pretoria, he and his officers were finally handed over to the British Government. They were tried and convicted in London, 'Dr. Jim' being sentenced to fifteen months' imprisonment; he was, however, released in Dec., 1896, owing to ill-health. He served in the South African War in 1899 and 1900, was elected member of the Cape Legislative Assembly in 1900, became director of the British South Africa Company in 1902, and was Premier of Cape Colony from 1904 to 1908. He was made a baronet in 1911, and in 1913 became chairman of the British South Africa Company.

Jamesone, George, Scottish portrait-painter, the son of an architect at Aberdeen, was born there in 1581, died at Edinburgh in 1644. He studied under Rubens at Antwerp, where he had Vandyck as a fellow-pupil. Returning to his native country in 1628, he became famous as a portrait-painter. He also painted historical pieces and landscapes. His excellence consists in delicacy and softness of shading, and a clear and beautiful colouring.

James River, a river of the United States, in Virginia, which passes the towns of Lynchburg and Richmond, and communicates, through Hampton Roads and the mouth of the Chesapeake Bay, with the Atlantic. Its general course is east-south-east, and its length is 450 miles. The first English settlement in America was formed at Jamestown, 32 miles from the mouth of this river, in 1607.

James's Bay, the southern extension of Hudson Bay, called from Captain James, who wintered there in 1631–2 while trying to find the north-west passage. It has numerous rocks and islands, and its navigation is dangerous.

Jamestown, a town of the United States, in Chautauqua county, New York, on the outlet of Chautauqua Lake, which supplies water-power, and is employed in several mills. It has manufactories of woollens and alpaca. Pop. (1920), 38,917.

Jamieson, John, a Scottish philologist and theologian, was born at Glasgow 1759, educated for the ministry among the Antiburgher Seceders, and after having been settled for a time in Forfar, removed in 1797 to Edinburgh, where he spent the remainder of his life, and died in 1838. The work by which he is chiefly known is his *Etymological Dictionary of the Scottish Language* (1808–9; Supplement 1825), highly valuable as an extensive collection of Scottish words, phrases, and customs.

Jamno'tri, or **Jumnoutri,** a celebrated place of pilgrimage in Hindustan, in the province of Garhwal, 185 miles N.N.E. of Delhi, at the source of the Jumna, with hot springs 10,849 feet above sea-level.

Jamuna (*ja*-mų-nä'), the name of several rivers of Northern India, the chief being the lower section of the Brahmaputra, and that which connects it directly with the Ganges.

Janesville, a city of the United States, in Wisconsin, on both sides of Rock River, with active trade and manufactures. Pop. (1920), 18,293.

Janina, or **Joannina** (yȧn'i-nȧ, yo-ȧn'i-nȧ), a town of Greece, near the Albanian frontier, 425 miles w.s.w. of Constantinople, beautifully situated on the margin of a lake stretching along the greater part of its western shore. It has declined since the time when the notorious Ali Pasha, the Lion of Janina, resided here from 1788 to 1822. Its fortress and splendid seraglio, built on a promontory jutting down into the lake, are now in ruins. The town was taken by the Greeks during the first Balkan War on 5th March, 1913, and was occupied for a short time by the Allies during the European War. Pop. 25,000.

Jan′izaries, or **Janissaries** (Turk. *Jenitcheri,* new soldiers), an Ottoman infantry force, somewhat analogous to the Roman prætorians, part of them forming the guard of the Sultan. They were originally organized about 1330, and subsequently obtained special privileges, which in time became dangerously great. The regular janizaries once amounted to 60,000, but their numbers were afterwards reduced to 25,000. The irregular troops amounted to 300,000 or 400,000. Their power became so dangerous and their insurrections so frequent that several unsuccessful attempts were made to reform or disband them. At various times Sultans had been deposed, insulted, and murdered by the insurgent janizaries. At last, in June, 1826, they rebelled on account of a proposal to form a new militia, when Sultan Mahmoud II, having displayed the flag of the Prophet, and being supported by their aga or commander-in-chief, defeated the rebels and burned their barracks, when 8000 of them perished in the flames. The corps was abolished, and a curse laid upon its name. As many as 15,000 were executed, and fully 20,000 were banished.

Jan-Mayen (yán-mī′en), a small volcanic island in the Arctic Ocean, 150 miles from the coast of East Greenland. In Beerenberg, an extinct volcano, it rises to the height of 6870 feet. The island was discovered in 1611 by the Dutch navigator Jan Mayen.

Jan′senists, or **Jan′senism,** the sect or party and its doctrines which owed their origin to the teaching of Jansenius (q.v.). In his great work *Augustinus,* published in 1640, Jansenius maintained the Augustinian doctrine of free grace, and recommended it as the true orthodox belief, in opposition to the semi-Pelagianism of the Molinists. The book was condemned by Urban VIII in 1642, in the Bull *In Eminenti*; but its doctrines were supported by many distinguished French and other theologians, and the scholars of Port-Royal, namely, Nicole, Pascal, and Antoine Arnauld, undertook the defence of Jansenism. Another Bull, in which the Pope (1653) particularly condemned five propositions from the *Augustinus,* also met with a strong opposition. In 1656 Alexander VII issued a special Bull by which the Jansenists were compelled either to recant or secede from the Roman Church. It was found impossible to force them to an unconditional subscription of this Bull; and in 1668 an agreement with Clement IX, by which a conditional subscription was permitted, obtained for them a temporary repose. The party stood its ground under the protection of Innocent XI (died 1689), who favoured them as much as Louis XIV and the Jesuits opposed them. Father Quesnel's *Moral Reflections on the New Testament*—the most universally read book of this period—gave it new support, but also led to the Bull *Unigenitus* (in 1713), which condemned 101 propositions from the *Reflections.* This Bull excited much indignation in France, and was strongly resisted; but the Jansenists were rigorously persecuted unless they accepted the Bull unconditionally. In consequence great numbers emigrated to the Netherlands, and their power as a party rapidly declined. This was hastened from 1731 by the fanatical excesses of many Jansenists, especially of the Convulsionists (q.v.) and others, which encouraged ridicule, favoured repressive measures, and ultimately extinguished the Jansenists as a party in France. As a sect, however, they still survive in the Netherlands, having a membership of about 8000. They call themselves, by preference, the *disciples of St. Augustine.* Each bishop on his appointment notifies his election to the Pope, and craves confirmation. The non-acceptance of the Bull *Unigenitus,* however, has caused all their advances to be rejected, and as they have rejected the doctrine of the immaculate conception and the decrees of the Vatican Council, they stand further apart than ever from the orthodox Catholic Church, though between them and the Old Catholics there are friendly relations.—Cf. L. Séché, *Les Derniers Jansénistes.*

Janse′nius, Cornelius (properly *Cornelisz Jansen*), a Dutch theologian, born in 1585, died in 1638. He studied at Utrecht, Louvain, and Paris; secured a professorship at Bayonne; returned to Louvain in 1617, where he obtained the degree of doctor, and took a prominent part in the affairs of the university. He was appointed professor of Scripture in 1630, and was promoted to the bishopric of Ypres in 1636. In this city he died of the plague, leaving an unblemished reputation for piety and purity of morals. He had just completed his great work the *Augustinus,* a book which gave rise to a great religious controversy. See *Jansenists.*

Janssens (jáns′sens), Abraham, Flemish historical painter, born about 1575, died about 1632. He was the contemporary and rival of Rubens, though he occupies a very subordinate place beside him. His work is notable for rich colour and bold design. Many of his pictures are in the Flemish churches, while others are in the galleries of Munich, Vienna, Berlin, Dresden, and Antwerp.

Janssens, Cornelis, or **Johnson**, Cornelius, painter, born in 1593 in London, probably of Dutch parents, died in Holland 1664. He worked in England from 1618 to 1643, and was employed by James I and Charles I. His work, some of miniature size, includes portraits of these two kings, Sir George Villiers, and John Milton as a boy. In 1643 he settled in Holland. His paintings are for the most part in private collections, but he is represented in the National Gallery.

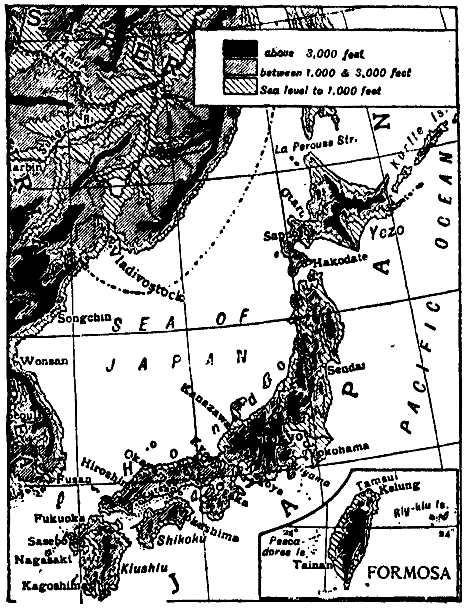
Janua′rius, St., Bishop of Benevento, was beheaded at Pozzuoli in the beginning of the fourth century, a martyr to the Christian faith, and is honoured as the patron saint of the people of Naples, where his body lies buried in the crypt of the cathedral. His head, with two phials of his blood, are preserved in a separate chapel. These phials are brought near the head of the saint on three festivals each year, notably 19th Sept., the anniversary of the martyrdom. On these occasions, if the blood becomes of a clear red colour and moves briskly in the phial, the patron saint is said to be propitious, but by remaining congealed it betokens disaster.

Jan′uary, the first month of the year, consisting of thirty-one days. It was by the Romans held sacred to Janus, from whom the name was derived. The Roman year originally began with March, and consisted of only ten months. Numa is said to have added January and February. See *Calendar*.

Janus, an ancient Latin divinity, after whom the first month of the year was named. He was held in great reverence by the Romans, and was represented with two faces, one looking forward, the other backward. All doors, passages, and beginnings were under his care. His principal festival was New Year's Day, when people gave each other presents. The temple of Janus, which was open in time of war and closed in time of peace, was shut only three times in the long space of 700 years—once in the reign of Numa, again after the first Punic War, and the third time under the reign of Augustus A.U.C. 744. Vespasian also closed it in A.D. 71. There was also a goddess, Jana, although she never became prominent in the State religion.—Cf. W. W. Fowler, *The Roman Festivals*.

Japan′, an island empire in the North Pacific Ocean, lying off the east coast of Asia. It comprises five large mountainous and volcanic islands, viz. Honshu (mainland), Kyushu, Shikoku, Hokkaido (Yezo), and Taiwan (Formosa), besides many others, and the peninsula Chosen (Korea) and the southern half of the Island of Sakhalin (Karafuto). The largest island, Honshu, Hondo, or Nippon, is 800 miles long, and from 50 to 100 miles broad. By the Japanese Nihon or Nippon is employed to describe the whole empire. The name 'Jipun', altered by Europeans to Japan, is the Chinese designation. The area of the Japanese Empire, including Sakhalin and Korea, is 260,738 sq. miles, with a pop. of 77,005,510 (1920).

Physical Features.—The Japanese islands form part of the line of volcanic action commencing with the Aleutian Isles and terminating in the islands of South-Eastern Asia. The coasts of the larger islands are extremely irregular, being deeply indented with gulfs, bays, and inlets, which form magnificent harbours. The surface also is generally uneven, and in many instances rises into mountains of great elevation. The Island of Honshu is traversed throughout its whole length by a chain of mountains, the highest peak being Fuji-yama (12,230 feet), a dormant volcano covered with perpetual snow. The volcanic vents are numerous in Yezo, Honshu, and Kyushu, and earthquakes are frequent. The minerals comprise copper, lead, iron, antimony, and sulphur; gold and silver are found, though not to a great extent. Coal is mined in various parts. The rivers are of no great length; Tonegawa, the longest, is only about 172 miles. Biwa, in the south of Honshu, is the principal lake, being some 50 miles in length, with an



Japan: Surface Features

extreme breadth of 20 miles. The harbours most frequented by foreign vessels are Yokohama—the port of Tokyo, the capital—Kōbe (Hiogo or Hyogo), Nagasaki, Hakodate, Niigata, and Osaka.

Climate.—The climate ranges from an almost Arctic cold in the north to a nearly tropical heat in the south. In the Island of Yezo winter begins about October and continues to April, its course being marked by severe frosts and snowstorms; while in Yokohama, again, the winter is genial, with a bright sky, and a temperature much like England. From July to September the thermometer often ranges as high as 95° in the shade.

Products.—The vegetation of Japan is very varied, in consequence of its wide range of temperature. Rice of excellent quality, as also wheat, barley, sugar-cane, and millet are largely grown; while ginger, pepper, cotton, and tobacco are cultivated in considerable quantities. Tea is extensively planted. The Japanese are skilful gardeners, and the fruits raised include strawberries, melons, plums, persimmons, figs, loquats, and oranges. Of flowers and flowering shrubs the camellia, azalea, hydrangea, lilies, peonies, the chrysanthemum, daphne, and wistaria are indigenous. The forests are extensive; in the south the palm, banana, and bamboo flourish; while in the north, cedar, pine, maple, camphor, and the *kadsi* or paper-tree are abundant. The chief domestic animals are the horse, which is small and hardy; the ox, which is used as a beast of burden; the dog, which is held sacred; and the cat, which is of a short-tailed species. Rabbits and guinea-pigs are household pets. Bantam fowls, chickens, ducks, and pigeons are reared for food. Of the wild animals, deer are numerous in the north, bears are to be found in Yezo, while boars, wolves, badgers, foxes, monkeys, and hares are not uncommon. Birds are plentiful: falcons, pheasants, ducks, geese, teal, storks, pigeons, ravens, larks, pelicans, cranes, herons, &c. Fish is one of the chief foods, the principal varieties being salmon, cod, herring, sole, and mullet. There are also tortoises, lizards, scorpions, and centipedes; and of the insect tribes there are white-ants, winged grasshoppers, and several beautiful varieties of moths. A considerable number of the Japanese animals are the same as those of Britain, or little different.

People.—The Japanese may be regarded as belonging to the great Mongolian family, though ethnologists recognize more than one element in the population. They are generally distinguished by broad skulls and high cheek-bones; small black eyes, obliquely set; long black hair, and a yellow or light-olive complexion; some are good-looking, and many are well-made, active, and nimble. They are a frugal, skilful, persevering, courageous race, who combine these characteristics with much frankness, good humour, and courtesy. A Japanese gentleman's dress is a loose garment made of silk, gathered in at the waist by a girdle, and extending from neck to ankle; while over this is thrown a wide-sleeved jacket. In the country a short cotton gown is worn, while the lower classes generally wear but scant clothing. The hair is shaved off the front part of the head, while on the back and sides it is gathered up into a knot and fastened with long pins. As regards both clothing and hairdressing the women very much resemble the men. They also paint and powder themselves to excess. Polygamy is not practised, but a husband can have as many concubines as he can afford. The Japanese are a holiday-loving people, and delight in the theatre. Their two principal religions are Buddhism and Shintoism. The chief observances of Shintoism are ancestral worship and sacrifice to departed heroes. Buddhism is the popular religion. A considerable number of Christian missionaries are actively engaged in the country. The Japanese language is dual in its nature. Originally a polysyllabic Mongolian tongue, it has been greatly enriched by the addition of many Chinese words, the latter being much used by the literary and governmental classes.

Industries and Trade.—In native and imitative manufactures the Japanese are exceedingly ingenious. Their artistic treatment of copper, iron, bronze, silver, and gold is of the finest; while in stone carvings, mosaics, wicker, tortoise-shell, crystal, leather, and especially in wood lacquer-work, they are skilful in the highest degree. Of textile fabrics they excel in cotton goods, crapes, camlet, brocades, but chiefly in figured silk. Paper is largely made, and its uses—from a house to a handkerchief—are manifold. Japanese decorative art is remarkable for patient but facile treatment of bird, beast, and flower; the absence of perspective and chiaroscuro seems even to add to its effect. The modern art productions, however, have been debased by European influence. In recent times factories and workshops of the European type have sprung up, cotton-mills being especially numerous, and few modern industries are now unrepresented in Japan. The chief export is raw silk, others are silk goods, cotton yarn, tea, coal, copper, matches, cotton goods, straw plait, porcelain, &c., while the imports are mostly raw cotton, textile fabrics, machinery and metal goods, sugar, mineral-oil, rice, flour, &c. The exports in 1920 were valued at £194,838,946, the imports at £233,617,478. Railways have a length of 7834 miles, telegraphs and telephones are common, while the postal system is excellent. A railway tunnel under the Moji-Shimonoseki Straits was begun in 1920. The standard money unit is the gold *yen* or dollar, of the value of 2*s.*, divided into 100 *sens.* The coinage consists of gold, silver, nickel, and copper pieces, from the value of 20 *yens* to $\frac{1}{10}$ *sen.* There is also a paper currency. The principal weight is the *picul*=133 lb. avoirdupois.

Government, &c.—The government of Japan was formerly an absolute monarchy, but a new Constitution was proclaimed on 11th Feb., 1889, providing for the establishment of a House of Peers, partly hereditary, partly elective, partly nominated by the emperor or Tennō, and of a House of Commons of elected members. The Upper House numbers 373 members, the Lower House 381, the latter being elected by all men twenty-five years of age and paying taxes to the amount of 10 yens annually. There is also a Cabinet, which includes the Prime Minister, and the statesmen at the head respectively of the Foreign Office, the Treasury, the interior, war, navy, education, justice, agriculture and commerce, communications. There are resident ministers in most European countries and in the United States. Education is compulsory, the school age being from the sixth to the fourteenth year. There are four universities, one of these at Tokyo, and all supported by the Government. Conscription is the rule, and the army is comparatively large and thoroughly efficient, as shown not only in the Russo-Japanese but also in the European War, when Japan dispatched, in 1918, 60,000 men to Siberia. The navy has been considerably increased since the Russo-Japanese War, and is highly up-to-date and modern. Formerly the Japanese warships were built in Europe and mostly by British firms, but now there is a great modern dockyard and arsenal called the *Kawasaki* at Kobe, and a second yard, the *Mitsubishi*, at Nagasaki. The estimated revenue for 1919–20 was £109,886,097; the national debt is over £264,609,894.

History.—The Japanese profess to have an accurate chronology from 660 B.C., but it is not until the tenth century after Christ that their history can be traced with any detail. Buddhism entered the country in the sixth century from Korea; subsequently for several centuries the relations of Japan and China were very close, and Chinese civilization had an immense influence upon that of Japan. The country was nominally ruled by a long line of hereditary *Mikados* or emperors, but for several centuries previous to the year 1867 the real power was in the hands of the *Shogun* or Generalissimo at Yedo, the Mikado living in retirement at Kioto. Marco Polo was the first European traveller who mentioned Japan, which he called Cipango, or Zipangou. The country was visited by the Portuguese Mendez Pinto in 1542, and soon after the Portuguese obtained permission to form a settlement at Nagasaki for purposes of trade. In 1549 Francis Xavier, the Jesuit missionary, arrived and converted many of the natives to Christianity; but the authorities, growing jealous of the Portuguese, and apprehensive of the results of the spread of Christianity, drove out the traders in 1585 and commenced a fierce persecution of the converts. In 1640 the Portuguese were finally expelled, and from that time for more than two centuries the only Europeans with whom the Japanese held intercourse were the Dutch, and they were kept closely shut up in their factory at Deshima (Nagasaki). In 1854 both the United States and Great Britain obtained treaties which promised to open up a trade with Japan. But a much more important treaty was negotiated by Lord Elgin in 1858, by which five ports were opened to British commerce, the United States and other European countries securing like advantages. In 1868 a revolution overthrew the power of the Shogun, and the Mikado was restored to his old authority. The imperial residence was removed from Kioto to Yedo, which has continued to be the seat of government, but with its name changed to Tokyo (Eastern Capital). Western ideas and Western civilization were now welcomed: the educational system was remodelled, and the laws recast; universal conscription was introduced instead of the custom of utilizing only the services of the warrior *samurai* class; the army and navy were organized and trained on Western lines, the finances of the country put on a sound basis, and a code of local government elaborated; lighthouses, railways, telegraphs, and telephones constructed, recourse being had in everything to the services and help of Western experts. In 1875 the southern half of Sakhalin was given up to Russia in exchange for the Kuriles; in 1876 Korea had to sign a treaty of amity and commerce with Japan. At home a formidable rising of discontented *samurai* took place in 1877, and was only put down after a sharp struggle. Local government was then gradually introduced; in 1889 a Constitution was promulgated, and two years later the first Japanese Parliament met.

In 1894 events in Korea led to a war with China, the corrupt Korean Government having appealed to China when called upon for redress of injuries to Japanese subjects. In this war the Japanese followed up successes on land by the great naval victory over the Chinese fleet at the Yalu River, further triumphs being the capture of Port Arthur, Talienwan, and Wei-hai-wei, at which latter place the remains of the Chinese fleet was destroyed or captured. This ended the war, and by the Treaty of Shimonoseki (1895) China agreed to pay a large war indemnity and to hand over Port Arthur and the Liaotung Peninsula to Japan. Russia, Germany, and

France, however, stepped in and forbade the acquisition of this mainland territory, recommending the acceptance by Japan of Formosa and the Pescadores Islands by way of exchange. The national pride was deeply hurt by this interference, but the Japanese were not strong enough to resist it. They at once set themselves, however, to increase the strength and efficiency of their army and navy, a resolve in which they were confirmed by the 'lease' in 1898, and the subsequent fortification by Russia, of Port Arthur, in the same Liaotung Peninsula from which they themselves had been excluded. The various Western nations still retained those rights of extra-territoriality by which their own courts in Japan were empowered to judge their subjects resident in that country, rights which now seemed to the Japanese insulting. Great Britain was the first European Power to give up the privilege of special jurisdiction by a new treaty concluded in 1894, to take effect in five years; and in 1899 the other nations followed the lead thus given. During the Chinese 'Boxer' troubles in 1900 Japan was requested by the Powers to send a division to maintain order in the province of Pechili, and her soldiers took a distinguished part in the subsequent advance on Peking. In 1902 a defensive alliance for five years was concluded between Japan and Great Britain, for safeguarding their interests in China and Korea, the allies agreeing to stand neutral should one of them be attacked by another Power, but to intervene if more than one Power should join in the attack.

In the meantime Russia, disregarding her repeated promises to evacuate Manchuria by a fixed date (after occupying it ostensibly on behalf of order), had been, on the contrary, consolidating her position there with a view to ultimate annexation, and had been threatening the independence of Korea. Japan felt the Russian advances to be vital to her own national existence, and, after protracted negotiations, on 6th Feb., 1904, she suspended diplomatic relations, and gave Russia notice that she would take independent action to secure her interests. Two days later the first shot of the war was fired by the Russians at Chemulpo, and the same night their adversaries made a successful torpedo attack upon the Russian squadron as it lay carelessly outside the harbour of Port Arthur. Following this initial success, which practically gave them for the time the mastery of the Pacific, Japanese troops were poured into Korea, from which their opponents retired before them, the Russian main squadron being kept, in the meantime, confined to the neighbourhood of Port Arthur. On 1st May, their fleet co-operating, the Japanese forced the passage of the Yalu River against the Russian defence and entered Manchuria; and later in the month General Oku's hard-won victory at Kinchau (Nanshan), on the narrow Kwantung isthmus, enabled them to seize Dalny, with its fine harbour, in close proximity to Port Arthur. An attempt by the Russians to relieve the threatened fortress on 14th–15th June, at Telissu, proved disastrous to them. The Russian fleet at Port Arthur tried to escape to Vladivostok, but was headed off, while a subsequent sortie on 10th Aug. led to a naval combat ending in the defeat of the Russians, several of whose ships made their way to neutral ports and were disarmed. The main body again retreated within the harbour. Four days later the Vladivostok squadron, which had come south for purposes of co-operation, was defeated by Admiral Kamimura in the Korean Straits. Meanwhile on land the Japanese had been steadily forcing the Russians northwards, and, as the result of continuous fighting round Liao-yang (27th Aug. to 3rd Sep.), compelled them by a flanking movement to evacuate the place after heavy losses on both sides. In October battles on the Shaho cost the Russians 60,000 men and the Japanese 16,000, while the two armies subsequently faced each other in elaborately-fortified winter quarters on opposite banks of the river. In the meantime the different fortifications at Port Arthur, deemed by the Russians almost impregnable, though gallantly defended, had been gradually falling before the valour and determination of their assailants, who, by their final capture at the end of November of the position known as 203-Metre Hill, were enabled to fire directly on the Russian warships still within the harbour, thus releasing Admiral Togo's blockading squadron for a well-earned rest. The capture of the strong forts of Ehrlungshan and Sungsushan in the closing days of the old year led to the capitulation of Port Arthur on 2nd Jan., 1905. The siege of Port Arthur, one of the most remarkable in history, was attended with an enormous sacrifice of life on both sides, more than one assault of the Japanese being repulsed with dreadful carnage. The next great event of the war was at Mukden, where a skilfully-concealed turning movement by the Japanese, now reinforced by Nogi's Port Arthur veterans and siege-guns, and by Kawamura, led to fierce fighting at the beginning of March. The Japanese generalissimo, Oyama, by his superior dispositions and initiative, outflanked Kuropatkin's right wing; and although the stubborn resistance of the Russians, and particularly of the rear-guard, as well as the distances to be covered and the numbers engaged—the Russians probably had 326,000 troops in the field—prevented a great Russian disaster, Oyama was able to force his opponent, after losses amounting to 175,000, to abandon Mukden and retreat towards

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Kharbin. At length the Russian 2nd and 3rd Pacific Squadrons, under Admiral Rozhdestvensky, after a lingering voyage from the Baltic, arrived in Far Eastern waters, only to be annihilated by Togo in the battle of the Sea of Japan (27th–28th May). Soon after President Roosevelt intervened and persuaded the two belligerents to send representatives to America to discuss terms of peace; and plenipotentiaries met at Portsmouth, New Hampshire, at the beginning of August. The Japanese, having in the meantime occupied the Island of Sakhalin, long insisted upon its retention as one of the conditions of peace, this and the question of the payment by Russia of the costs of war being the two cardinal points of disagreement. Finally the Japanese magnanimously waived the money payment, and accepted the Russian proposal to divide Sakhalin (Japan retaining the southern half), the other main articles of the treaty of peace agreed to on 5th Sept., 1905, and signed by the respective emperors six weeks later, referring to the recognition of Japanese preponderance in Korea, the transfer to Japan of the Russian leases of Port Arthur and its territory, and a simultaneous evacuation of Manchuria by both parties within eighteen months. Thus Japan succeeded in gaining all the objects for which she went to war, and vindicated her right to be recognized as one of the leading nations of the world. At the end of the war Russia had some 500,000 men in the field, Japan probably more. A new treaty of alliance between Britain and Japan was signed on 12th Aug., 1905, wider in scope than the previous treaty, and to hold good for ten years. This treaty was renewed and amplified in 1911. Its declared objects were to maintain peace in the regions of Eastern Asia and India, to preserve the rights of the contracting parties in those regions, and to ensure the independence and integrity of the Chinese Empire; either party to assist the other against unprovoked aggression or attack. When the European War broke out, Japan joined the Allies, and issued an ultimatum to Germany ordering her to evacuate Kiaochow. Japanese troops captured Tsingtao on 1st Nov., 1914. By the Treaty of Versailles Japan was appointed mandatory to the former German possessions south of the equator, the Caroline Islands, and Marshall Islands.—BIBLIOGRAPHY: F. Brinkley, *Japan described and illustrated by Native Authorities*; E. W. Clement, *A Short History of Japan*; A. Stead, *Japan and the Japanese*; H. Norman, *Real Japan: Manners, Morals, Politics*; J. H. Longford, *Japan and the Japanese*; *The Evolution of New Japan*; Y. Okakura, *Life and Thought in Japan*; S. Greenbie, *Japan, Real and Imaginary*; L. Hearn, *Japan: an Interpretation*.

Japanning is the act of applying varnish to such articles as wood, metal, leather, and papier mâché, in imitation of the lacquered work of Japan and China. The article to be japanned, being made thoroughly dry, is first brushed over with two or three coats of seed-lac varnish to form the *priming*. The next coat of varnish is mixed with the *ground tint* desired, and where a design is intended it is now painted with colours. The whole is then covered with additional coats of varnish, which are dried and polished as applied. Shellac varnish or mastic varnish is employed, unless where the fineness or durability of the work requires the use of copal dissolved in alcohol. See *Lacquering*.

Ja′pheth, the second son of Noah (*Gen.* ix, 24). His descendants, according to *Gen.* x, 5, peopled the isles of the Gentiles, and thus Japheth is often considered the ancestor of most European races.

Japura (*h*ȧ-pö′rȧ), or **Caqueta** (kȧ-kā′tȧ), a large river of South America, an affluent of the Amazon. It has its sources in the mountains of Colombia, and its whole length is upwards of 1000 miles, the last 350 miles being in Brazilian territory. The navigation is interrupted by a great cataract, which is in lat. 1° 10′ s.; long. 72° 20′ w.

Jar′gon, or **Jar′goon** (Ar. *zargun*), a greyish variety of zircon (q.v.) found in Ceylon. The name originated that of the element zirconium.

Jarnac (zhȧr-nȧk), a town of France, in the department of and on the river Charente, where a battle was fought (13th March, 1569) between the Catholics under the Duke of Anjou and the Huguenots under the Prince of Condé. The Protestant forces were defeated. Pop. 4550.—*Coup de Jarnac* is a phrase derived from the famous lucky backstroke of the Comte de Jarnac in his duel with Châteigneraie in 1547.

Jaroslau (yȧ′ro-slou), or **Jaroslaw**, a town of Poland, in Galicia, formerly belonging to Austria. It lies on an affluent of the Vistula, 62 miles W.N.W. of Lemberg, with a castle and a handsome cathedral, manufactures of woollens and linens, &c. During the European War Jaroslau was taken by the Russians on 21st Sept., 1914, recovered by the Austrians soon afterwards, captured once more by the Russians in Oct., 1914, but again recovered by Austro-German troops in May, 1915. Pop. 25,000.

Jaroslav (yȧ′ro-slaf), a town of Russia, capital of the government of same name, on the Volga, 162 miles north-east of Moscow. It is the see of an archbishop, and has a theological seminary and a college. Pop. 120,000.—The government has an area of 13,723 sq. miles, and a pop. of 1,416,700 (1915). The surface is generally flat, and in several places very marshy. It is watered by the Volga and other rivers. The soil is by no means fertile, and the grain produced falls short of the home consumption.

Jar'rah, a timber tree of Western Australia, the *Eucalyptus margināta* (or *rostrāta*), yielding a very durable wood, useful for railway-sleepers, jetties, &c., not being liable to the attack of the white-ant and the ship-worm.

Jar'row, a town of England, in Durham, on the Tyne, 6 miles below Gateshead. Its rapid growth from a village to a large town is due to the development of its shipbuilding and iron-smelting industries. The town contains a mechanics' institute, an infirmary, and the church of St. Paul's, where the Venerable Bede was buried, and where some of his relics are still preserved. It gives its name to a parliamentary division of Durham. Pop. 35,590.

Ja'sher, Book of, a lost Hebrew work, twice mentioned in the Bible (*Josh.* x, 13 and *2 Sam.* i, 18), and about which various conjectures have been made. Some authorities suppose that it was a series of annals; others that it was a Hebrew minstrelsy celebrating the exploits of the national heroes. Whatever its contents may have been, it seems from the specimens preserved to have been metrical in form. The attempt made by Donaldson to reconstruct the *Book of Jasher* has met with little favour from Oriental scholars.

Jasmin (zhȧs-maṉ), Jacques, or **Jaquou Jausmin**, the chief modern Provençal poet of France, inheritor of the language as well as the spirit of the troubadours, was born in 1798, and died in 1864. Himself of humble parentage, and by trade a hairdresser, all his poems and songs are written in the peasants' patois of the Garonne. His poetry deserved and acquired more than a local celebrity, and was warmly welcomed not only in Southern France, but throughout the whole of Europe. His works were crowned by the Academy in 1852. His principal works are: *Lou Chalibari* (The Charivari), a mock-heroic poem; *L'Abuglo de Castel Cuillé* (The Blind Girl of Castel Cuillé), his masterpiece in poetry, which has been translated by Longfellow; *Las Papillotos de Jasmin* (The Curl-papers of Jasmin); and *Lous dous frays-bessous* (The Two Twin-brothers), 1847.

Jas'mine, or **Jas'min**, the popular name of plants of the genus Jasmīnum. They are graceful, branched, erect or climbing shrubs, with imparipinnate, trifoliolate, or simple leaves, and (usually cymose) white or yellow flowers, from some of which delicious perfumes are extracted. There are about 100 species, most of them Asiatic; some occur in South and a few in tropical Africa, while one is a native of Southern Europe. The Carolina jasmine is *Gelsemium nitidum*. Also written *Jessamine*.

Jason, in Greek legend, King of Iolcos in Thessaly, celebrated for his share in the Argonautic expedition. On his return to Iolcos with Medea as his wife, he avenged the murder of his parents and his brother by putting Pelias to death. Unable to retain possession of his throne, however, he fled to Corinth, where, after some time, he married Glauce (or Creusa), daughter of the king, and put away Medea and her children. (See *Medea*.) Different accounts are given of his death. See *Argonauts*.

Jasper (Ar. *yasb*, *yashb*; Gr. *iaspis*), an impure coloured form of quartz or flint. It is entirely opaque, or sometimes feebly translucent at the edges, and presents almost every variety of colour. It is found in altered shales and metamorphic rocks. In many places banded jaspers pass into serviceable hæmatite iron ores. Jasper takes a high polish, and is used for vases, seals, snuff-boxes, &c. There are several varieties, as red, brown, blackish, bluish, Egyptian (a striped brown variety).—*Agate jasper* is jasper in layers with chalcedony.—*Porcelain jasper* is only baked clay.

Jassy (yȧsh'shi), a town of Roumania, in Moldavia, on the Bachlui, several miles from the Pruth. It is built on two hills, and covers a large space, the houses being generally provided with gardens. It has a university, a museum

Jasmine (*Jasmīnum officinale*)

with a public library, a theatre, several hospitals, fine hotels and shops. There are few manufactures, but the trade is of some importance, and a great deal of business is done at the fairs. During the European War, when, in Dec., 1916, the Roumanians were compelled to leave Bukarest, Jassy became the seat of the Government until the conclusion of the armistice. Pop. 75,882, over a third of whom are Jews.

Jasz-Berény (yäs-be-rāny′), a market town of Hungary, 38 miles E.N.E. of Budapest, on both sides of the Zagyva. Pop. 26,791.

Ja′taka, a story in which Buddha in one of his former births plays some part. The term is applied to a collection of such Jatakas, a work of about the third century A.D., containing legends relating to the birth of Buddha, and much prized by the Buddhists.

Jativa (*hä′tē-vȧ*), a city of Spain, province of and 36 miles S.S.W. of Valencia, near the confluence of the Guardamar and Albayda. Pop. 12,737.

Jat′ropha, a genus of woody plants with alternate stipulate leaves and cymes of small flowers, belonging to the nat. ord. Euphorbiaceæ, for the most part inhabiting the tropical parts of America. Some species have stinging hairs. *J. elastica* yields an elastic substance used as caoutchouc. See *Physic-nut.*

Játs, a race of Hindu agriculturists of fine physique, providing very valuable recruits to the Indian army. In the sixteenth century the Játs were the preponderating factor in the Punjab, and, consequently, provided to a very great extent the original stock on which Sikhism was grafted by Nanak, the founder of that religion. To this day the most considerable and influential division of the Sikhs is that of the Ját, or, as it is pronounced in this connection, Ját Sikh. Sikhism was not the only proselytizing influence which affected the original Játs; large numbers of them also became Mahommedans, either from motives of policy or in some cases from *force majeure*. The Ját, both Hindu and Mahommedan, makes a fine soldier. His physique is excellent, and though he is perhaps not overburdened with brains, yet his fighting powers and qualities of endurance more than counterbalance any shortcomings there may be in that direction.

In the Punjab Játs are found in greatest strength in the tract of country lying between the Indus, Jhelum, and Chenab Rivers north of Multan, a district known as the Sind Sagar Doab. While in Rájputána and Sind they populate a considerable area to the south of Jodhpore and extending as far as the Indus.

Játs have in the past provided a complete cavalry regiment, the 14th Murrays Ját Lancers, and two infantry regiments, the 6th Royal Ját Light Infantry and the 10th Játs. The 14th Lancers has lately been amalgamated with the 15th, though it will still retain its Ját connection. The 6th Ját Light Infantry received the title Royal in 1920 as an honourable reward for its service in the European War. In addition to these units with a special Ját connection, several other regiments, both cavalry and infantry, enlist these fine soldiers.

Jauer (you′ėr), a town of Germany, in Silesia, 10 miles S.S.E. of Liegnitz, on the Neisse, with manufactures of cigars, cloth, worsted, and leather. Pop. 13,550.

Jaundice is due to the presence of bile pigments in the blood, and is recognized by the yellow colour produced in the skin. The yellow tinge is first seen in the conjunctiva of the eye. There are two main types of jaundice: (1) *toxæmic*, due to the presence of some toxic body of chemical or microbic origin circulating in the blood; (2) *obstructive*, caused by the mechanical obstruction of the bile-ducts, due to pressure. The *toxæmic* type is produced by various chemical poisons, such as chloroform, phosphorus, &c,, and by the microbic poisons of such diseases as malaria, relapsing fever, syphilis, and yellow fever. *Obstructive jaundice* may be produced by inflammation in the bile-duct itself, by the bile-duct being blocked by calculi (bile-stones); or as the result of pressure on the duct by tumours of the liver, pancreas, stomach, or upper part of the bowel. It is only in this type, sometimes called *black jaundice*, that the skin becomes a dark-green colour.

Jaunpur (joun-pör′), a town of India, United Provinces, on the River Gúmti, over which there is a fine bridge. It is an old town, and has some beautiful specimens of architecture. Pop. 42,771. —The district has an area of 1554 sq. miles; pop. 1,209,663.

Jaurès, Jean Léon, distinguished French Socialist, born at Castres (Tarn) 3rd Sept., 1859, of well-to-do middle-class parents, assassinated 31st July, 1914. Educated in his native town and at the École Normale Supérieure, Paris, he became professor of philosophy at the Lycée for girls at Albi (Tarn), and later was appointed to the chair of philosophy at the University of Toulouse. In 1885 he was elected to the Chamber of Deputies. Four years later he was defeated, but was re-elected in 1893. He joined the Socialist party, devoting his talents to the effort of transforming the political republic into an economic and social republic. Jaurès soon became chief parliamentary leader, playing a prominent part at all the Socialist congresses and conferences. His activity during the Dreyfus trial made him many enemies in France, and the hostility against him increased when he advocated international peace and the reduction of armaments, and opposed the Three Years' Army Service Bill in the French Chamber. He was assassinated on the very eve of the European War by a youth named Raoul Villain. The assassin was tried in 1919 and acquitted.

Java, an island in the Indian Archipelago, the chief of the Dutch colonial possessions; capital, Batavia. It is separated by the Strait of Sunda from Sumatra, and by that of Bali from Bali, and extends about 630 miles from east to west; greatest breadth, 126 miles; area of Java and Madura, 50,557 sq. miles. Java and the smaller adjacent Island of Madura are divided into twenty-two provinces or residencies, of which the population in 1917 amounted to 34,157,383. Volcanic mountain chains running from east to west, and rising to such points as Semiru (12,250 feet) and Slamat (11,320 feet); low-lying marshy tracts in the north, with such safe landlocked harbours as Batavia and Surabaya; in the south a rocky unbroken coast washed by the heavy surf of the Indian Ocean—these are its chief characteristics. Volcanic eruptions are not infrequent, the latest being in 1883, when much damage was done to life and property. The mountains, covered with large forests, are separated by exceedingly fertile valleys. With the exception of marshy tracts the climate is as salubrious as that of any other intertropical country; and the more elevated regions are even healthy. The vegetation is varied. Rice is the chief cereal, but coffee and sugar are the staple products; spices are also grown, and some cotton is raised. Other products comprise rubber, pepper, tobacco, and tea. The famed poison-tree, or upas (*Antiaris toxicaria*), is a noted Javanese plant. The forests consist mainly of teak. There are about 100 kinds of mammalia inhabiting Java. These include the one-horned rhinoceros, tiger, panther, tiger-cat, wild hog, several kinds of deer, several monkeys (but not the orang-utan), and enormous bats. The ox, the buffalo, and the goat are among the domestic animals. Birds are numerous. Serpents of a venomous kind are frequent, as also are crocodiles, lizards, and the land tortoise. The native population belong to the Malay race, and are brownish-yellow in complexion, with long thick black hair. They are sober, patient, and industrious, but quick to avenge affront. In religion they are nominally Mahommedan. The great mass are devoted to agriculture, living in villages each governed by a native chief. Most of the land belongs to the Dutch Government, which obtains a large revenue from the island. Till 1882 it was the custom to utilize the forced labour of the natives in what was called the ‘culture system’. In that year very many of these enforced services were abolished, and in 1914 the remainder were also abolished. The principal exports are coffee, sugar, tea (the production of which is constantly increasing), tin, rice, cinchona, indigo, spices, tobacco, hides, and india-rubber. The exports in 1918 amounted to £56,653,657, and the imports to £47,316,980. Railways have been introduced, and telegraphic communication rapidly developed. A Governor-General rules Java and the whole of the Dutch East Indies. The history of Java is unknown previous to the eleventh century, when the Hindus founded a dynasty and converted the natives to Brahmanism. This was overthrown by an invasion of the Mahommedans in 1478. Islamism was succeeded by the Portuguese, who arrived in 1511. They were followed by the Dutch in 1595, who wrested from them the supremacy.—BIBLIOGRAPHY: A. S. Walcott, *Java and her Neighbours*; J. F. Scheltema, *Monumental Java*; E. R. Scidmore, *Java: the Garden of the East.*

Jay, John, American jurist and statesman, born in 1745, died in 1829. In 1768 he was admitted to the Bar, and in 1774 was chosen a delegate to the first American Congress, which met at Philadelphia. In 1776 he was chosen President of Congress, and in 1779 he was appointed Minister Plenipotentiary to Spain. In 1782 he was appointed one of the Commissioners to negotiate a peace with Britain, and, along with Adams and Franklin, concluded a treaty with the British. Returning to the United States, he was appointed head of foreign affairs, and afterwards Chief Justice. In 1794 he was sent as Envoy Extraordinary to Great Britain, and concluded a treaty which has been called after his name, and by which £200,000 was given to Americans as compensation on account of the illegal captures by British vessels, and the eastern boundary of Maine was fixed.

Jay, a genus and sub-family (Garrulinæ) of birds belonging to the family of the crows (Corvidæ). The jays have the upper mandible

Jay (*Garrulus glandarius*)

or bill notched or indented near its tip, and the feathers on the top of the head are erectile, and can be elevated at will, to form a kind of crest. These birds are readily domesticated, possess a harsh grating note, and are admirable mimics. They feed on fruits, seeds, worms, insects, and the eggs and young of other birds, &c. The common or European jay (*Garrŭlus glandarius*) is the size of an ordinary pigeon, the general colour is a light brown inclining to red, whilst the larger or primary wing-feathers are of a brilliant blue, marked out by bands of black. The blue colour reaches its highest brilliancy in the North American blue jay (*Cyanocitta cristātus*), which otherwise closely imitates its European representative both in size and habits. The blue jay is exceedingly well known in the United States. Another American jay is the Canada jay or ' whiskey jack ' (*Perisoreus canadensis*), a bird of rather sombre colouring, but of the bold, noisy, and active habits of others of the jays.—Cf. H. E. Dresser, *Birds of Europe.*

Jebb, Sir Richard Claverhouse, English classical scholar, was born at Dundee 27th Aug., 1841, died 9th Dec., 1905. Educated at St. Columba's College, Dublin, the Charterhouse, and Trinity College, Cambridge, he graduated as senior classic in 1862. In 1869 he became public orator of the university, was professor of Greek at Glasgow from 1875 to 1889, and was then appointed regius professor of Greek at Cambridge. His best-known works are: *The Attic Orators*; *Modern Greece*; a *Life of Richard Bentley*; *Homer: an Introduction to the Iliad and Odyssey*; his admirable edition of Sophocles, with notes and translation; and an edition of Bacchylides (1905). He was member of Parliament for Cambridge University from 1891 to 1905, was knighted in 1900, and received the O.M. in 1905.—Cf. Caroline Jebb, *Life and Letters of Sir Richard Claverhouse Jebb.*

Jedburgh, a royal burgh of Scotland, county town of Roxburghshire, on the Jed, with the ruined church of an abbey, a magnificent structure partly of the twelfth century, begun by David I; and a house where Queen Mary lived in 1556. The manufacture of woollen goods is carried on. Pop. (1921), 2426.

Jefferies, Richard, naturalist and author, born in Wiltshire in 1848, died in 1887. He began his literary career as a local journalist, and first attracted attention by a letter to *The Times* in Nov., 1872, on *The Wiltshire Labourer.* In 1877 he moved to London, gaining a success the next year with his book *The Gamekeeper at Home,* which consisted of sketches of natural history and rural life. He afterwards produced a number of works on similar subjects, together with a few novels. Among his more important works are: *The Amateur Poacher* (1880), *The Story of My Heart* (1883), *Life of the Fields* (1884), *The Open Air* (1885), and *After London, or Wild England* (1885).

Jefferson, Joseph, American comedian, born in 1829, died in 1905. He became an actor, a profession which his father, grandfather, and great-grandfather had followed, and speedily made a name for himself in such parts as Doctor Pangloss (*The Heir at Law*), Asa Trenchard (*Our American Cousin*), Bob Acres (*The Rivals*), &c. To English playgoers, however, he was best known for his finished impersonation of Rip Van Winkle, in his play of that name. In 1889 he published an *Autobiography.*

Jefferson, Thomas, the third President of the United States of America, was born 1743 at Shadwell, Virginia, died 4th July, 1826. He studied at the College of William and Mary, Williamsburg, and then commenced the study of law. In 1760 he was elected a member of the Provincial Legislature, and in 1775 he took his seat for the first time in Congress. It was he who drew up the draft of the Declaration of Independence, which (in a slightly modified form) was signed on 4th July, 1776. From 1779 to 1781 he was Governor of Virginia. In May, 1784, Congress elected him Minister Plenipotentiary to France, in addition to Adams and Franklin; next year he was appointed sole minister, and his residence in Europe lasted about five years. On his return he was appointed Secretary of State by Washington, an office which he continued to fill until the end of 1793, when he resigned. In 1797 he was elected Vice-President of the United States; but he was seldom consulted by the President, and he was out of harmony with the Government. In 1800 he was elected President. One of the public acts of his administration was the purchase of Louisiana from France, thus greatly extending the boundaries of the United States. In 1809 he retired to private life at his residence of Monticello, in Virginia, where he died on the fiftieth anniversary of the Declaration of Independence, almost at the same hour as John Adams, the second President. Jefferson was the acknowledged head of the Republican party from the period of its organization. He published *Notes on Virginia,* and various essays on political and philosophical subjects, and a *Manual of Parliamentary Practice,* for the use of the Senate of the United States.—BIBLIOGRAPHY: G. Tucker, *Life of Thomas Jefferson*; T. E. Watson, *Life and Times of Thomas Jefferson*; J. S. Williams, *Thomas Jefferson: his Permanent Influence on American Institutions.*

Jefferson City, a town of the United States, capital of Missouri, on the River Missouri. Pop. 14,067.

Jeffersonville, a flourishing town of the

United States, in Indiana, on a height above the Ohio, connected with Louisville by a fine bridge. Pop. 10,412.

Jeffrey, Francis, Lord, a Scottish judge and critic, was born at Edinburgh in 1773, and died in 1850. He was educated at Edinburgh High School, the University of Glasgow, and Queen's College, Oxford, and passed advocate in 1794. He took part in establishing the *Edinburgh Review* in 1802 (with Sydney Smith, Lord Brougham, and others), and after two numbers had been issued was installed as its editor, a position he held for twenty-six years. In 1831 he was made Lord-Advocate, and he sat for several years as member of Parliament for Edinburgh. He was made a Lord of Session in 1834, and continued during a period of sixteen years to be one of the ablest and most popular judges of the Supreme Court in Scotland.—Cf. H. T. Cockburn, *The Life of Lord Jeffrey*.

Jeffreys, George, first Baron, English judge, was born in 1648, and died in the Tower in 1689. Soon after commencing his professional career he was chosen recorder of London; and he was appointed, successively, a Welsh judge and Chief Justice of Chester, created a baronet in 1680, and afterwards appointed Chief Justice of the King's Bench. He was one of the advisers and promoters of the arbitrary measures of James II; and for his sanguinary and inhuman proceedings against the adherents of Monmouth on the 'bloody western circuit' was rewarded with the post of Lord High Chancellor (1685). On the arrival of the Prince of Orange, the Chancellor, who had disguised himself as a seaman, was detected and carried before the Lord Mayor, who sent him to the Lords in Council, by whom he was committed to the Tower.—Cf. H. B. Irving, *Life of Judge Jeffreys*.

Jeho'vah is the proper name of the God of the Hebrews, the English Bible's equivalent for the sacred personal name, which occurs 6823 times in the Hebrew Old Testament. The pronunciation, the derivation, and the origin of the name are uncertain.

(*a*) The pronunciation 'Jehovah' is certainly erroneous. It is a mediæval, hybrid formation, due to the fact that the consonants of the Hebrew term YHWH were supplied with vowels answering to the terms for Lord (Adônai) or God (Elôhim). The Jews shrank in superstitious reverence from pronouncing the actual name or Tetragrammaton, and devised this method of employing the consonantal framework. Jehovah, therefore, is no more than a conventional and convenient makeshift. Scholars are now agreed on philological evidence that the original pronunciation must have been something like 'Yahweh'.

(*b*) The etymology is more obscure. One derivation is offered in *Ex.* iii, 14, 15, where Moses asks for information about the name of the God who is sending him to lead Israel from Egypt, and is told by God, "I will be what I will be". The meaning of this interpretation is that God will prove Himself to be something undefined, i.e. a helper and deliverer to His people. They are to expect Him to reveal Himself. On the eve of the struggle that is to free them from the tyranny of Egypt, God encourages them by promising to be One who will ever manifest Himself to His people. The interpretation is therefore not a metaphysical definition, but a practical description of Himself. 'I will be' in Hebrew is 'Ehyeh', and this is given as the clue to the meaning of Yahweh.

(*c*) This, however, can hardly be the origin of the name. It is a special application of it rather than the first introduction of it to Israel. Many attempts have been made to explain it from Semitic usage in a more concrete sense, e.g. as "He who creates, or makes to be", "He who casts down (lightning, hail, &c., or, his foes)", or "He who blows". On this last hypothesis Yahweh would be a storm-god, and many of the theophanies in the Old Testament connect Him with the storm or wind; He would then be "at first a wind-god like the Assyrian Ramman or the Teutonic Woden" (W. E. Addis, *Hebrew Religion*, 1906, p. 66). Parallels to the name have been occasionally found in Canaanite and Babylonian mythology, and, according to Driver, it is possible that "a West Semitic deity, Ya-u, was known as early as 2100 B.C.". But, apart from these remote traces, the name is embedded in the name of the mother of Moses, for Jochebed (*Ex.* vi, 20) means 'Yahweh is glory'. This suggests that the tribe of Levi, to which the family of Moses belonged, worshipped Yahweh already. Other scholars, impressed by the close connection of Yahweh with Sinai, have inferred that Moses had recently known the God during his stay with the Kenites, who dwelt near Mount Sinai. "It by no means follows that the Mosaic conception of Yahweh was not different from and higher than the conception of him among the Kenites; still less that the Kenites knew and worshipped no other God than Yahweh" (C. G. Montefiore, *Hibbert Lectures*, pp. 51, 52). But the impulse which actuated Moses at this era may have been derived from the Kenite or Midianite worship which he had just encountered in the nomad tribes round Mount Sinai. However this may be, it is the special sense of the name and the special worship introduced by Moses which made Yahweh the God of the Hebrews. We are unable, in the conflicting state of the evidence, to determine to what extent, if at all, Yahweh was known to the Hebrews before the exodus. But thereafter

Yahweh is their God pre-eminently, and this is recognized by other peoples, as, for example, on the Moabite Stone.

Je'hu, the founder of the fifth dynasty of the Kingdom of Israel. He was a commander in the army of Jehoram, when Elisha sent one of the ' children of the prophets ' to consecrate him King of Israel at Ramoth-Gilead (895 B.C.). He immediately attacked Jehoram, whom he slew in battle, and then entered upon a work of extermination in which were slain seventy of Ahab's children, forty-two brothers of Ahaziah, King of Judah, and Hezekiah himself, as also Jezebel. He died after a reign of twenty-eight years. His name occurs more than once on the monuments discovered at Nineveh.

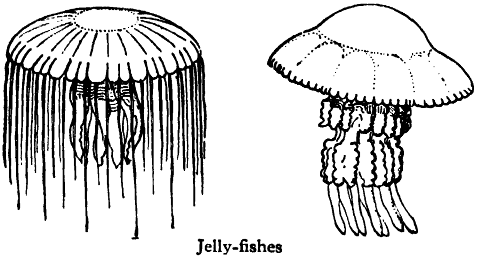
Jelalabad', a town of Afghanistan, near the right bank of the river and 75 miles E.N.E. of the town of Kabul. It was the scene of a successful resistance to an army of Afghans by a handful of British troops under Sir Robert Sale in the winter of 1841–2. Pop. about 4000.

Jellicoe, John Rushworth, first Viscount Jellicoe of Scapa, was born at Southampton, 5th Dec., 1859. He was educated at Rottingdean, and entered the navy in 1872. He served in the Egyptian War of 1882, and was the prizewinner at Greenwich (gunnery-lieutenants) in 1883. From 1898 to 1901 he was employed in China, and was Commandant of the Naval Brigade and Chief of Staff to Vice-Admiral Sir E. Seymour in 1900, during the attempt to relieve the Peking legations, being wounded in action. Director of Naval Ordnance from 1905 to 1907, he eventually became Rear-Admiral of the Atlantic Fleet, which he remained until his appointment as Third Sea Lord in 1908, when he combined with his duties those of Comptroller of the Navy. In 1910 he was posted to command the Atlantic Fleet, and in 1911 he took over the Second Squadron of the Home Fleet, striking his flag in 1912 on becoming Second Sea Lord. He was knighted (K.C.V.O.) in 1907.

Upon the outbreak of the European War, 4th Aug., 1914, Jellicoe was only a vice-admiral, but it had been arranged that he was to assume command in the event of a general mobilization; he was accordingly posted to Scapa upon that date, as Commander-in-Chief, Grand Fleet. On 28th Nov., 1916, he was superseded by Sir David (now Earl) Beatty (q.v.), and went to the Admiralty as First Sea Lord, where he was actively engaged in perfecting a system of defence and aggression against the growing ' U '-boat menace. After a short time as Chief of Naval Staff, subsequent to the reorganization of the Admiralty in May, 1917, Jellicoe retired (Dec., 1917), and was raised to the peerage as Viscount Jellicoe of Scapa. The thanks of the nation and a grant of £50,000 were presented to him on 5th Aug., 1919, when he was promoted to Admiral of the Fleet and toured the colonies, advising upon matters affecting naval construction and policy. He was appointed Governor-General of New Zealand in April, 1920, where he was enthusiastically received.

Jellicoe's books, *The Grand Fleet (1914–6)* published in 1919 and *The Crisis of the Naval War* which first appeared in 1920, do much to show the difficulties with which he had to contend in the early organization of the faulty equipment and raw personnel of the newly mobilized Grand Fleet; but, however, they have singularly failed to vindicate the strategic plan which enabled the High Seas Fleet at Jutland to escape the ' Nelson touch ' which the Grand Fleet were itching to administer. Among his decorations, Lord Jellicoe possesses the O.M. (1916), G.C.B. (1915), G.C.V.O. (1916), and the Grand Cross of the Legion of Honour.

Jelly-fishes, or **Medusæ**, the popular name of certain cœlenterate animals, of the class Hydrozoa, found in the sea, and often familiarly called sea-blubbers and sea-nettles, from their appearance and stinging property. When in the water they present a singularly beautiful appearance, one of the most common resembling a clear crystalline bell, which swims gracefully through the water by alternately expanding and contracting its body. They are very voracious, and paralyse their prey by means of the nettling cells that stud their long stinging tentacles. The phosphorescence of the sea is partly due to the pale light which they diffuse in the darkness See *Hydrozoa.*



Jelly-fishes

Thaumantias hemisphærica on left. *Rhizostoma Cuvieri* on right.

Jemappes (zhė-måp), a town of Belgium, in Hainault, near Mons, on the Scheldt, celebrated as the place of the first great battle in the French revolutionary war, fought 6th Nov., 1792, when the French under Dumouriez defeated the Austrians. Severe fighting also took place here during the European War (Aug., 1914).

Jena (yā'na), a town of Germany, in Saxe-Weimar, forming, since 1919, part of the Republic of Thuringia. It is an old-fashioned, uninteresting place, deriving importance only from its university (founded in 1558), which achieved its highest fame in the latter half of the eighteenth century, when among its teachers were Schiller, Hegel, Fichte, Humboldt, Schelling, and the Schlegels, while its students numbered above 1000. In 1920 there were over 2800 students and 185 professors and instructors, with an anatomical theatre, botanical garden, zoological museum and other scientific collections, observatory, and a library of 300,000 volumes. Pop. (1919), 48,504.—*The battle of Jena*, fought on 14th Oct., 1806, signalized the double defeat of the Prussians and the French. There were two separate engagements on the same day, one on the surrounding heights, between the Prussians under Hohenlohe and the French under Napoleon; and the other at Auerstädt, where the French general Davout was victorious.

Jenner, Edward, an English physician, celebrated for the introduction of the practice of vaccination as a preventive of smallpox. He was born at Berkeley, in Gloucestershire, in 1749, and died in 1823. After studying at Sodbury under Ludlow, the surgeon, and at London under the celebrated anatomist John Hunter, he settled in his native county as a medical practitioner. It was about 1776 when he first began to direct his investigations definitely to the subject of smallpox, taking as his starting-point the belief, common among the peasants, that the casual cowpox acquired in milking cows was a preventive of the more terrible disease. From this, after many experiments, he elaborated his famous process of vaccine inoculation, which was made known to the world in 1798, and in the same year introduced into St. Thomas's Hospital. His method at first met with great opposition from the medical profession, but was in the end universally accepted by his own and foreign nations. In 1802 a parliamentary grant of £10,000 was accorded him, and another of £20,000 in 1807, while congratulatory addresses were sent to him by Continental monarchs. He died of apoplexy at his native place, and in 1858 a public statue was erected in his honour in London. He published an *Inquiry into the Causes and Effects of Cow-pox* (1798); *Further Observations on Variolæ Vaccinæ or Cow-pox* (1799); and a celebrated paper on the Cuckoo, in the *Philosophical Transactions*. See *Vaccination*.—Cf. J. Baron, *Life of Jenner*.

Jenner, Sir William, born at Chatham in 1815, died in 1898. He was educated at University College, London, where he graduated M.D. in 1844. In 1848 he became professor of pathological anatomy, and in 1857 of clinical medicine in the University College; in 1861 physician to the queen; in 1862 professor of the principles and practice of medicine in University College; in 1868 he was made a baronet, and in 1872 a K.C.B., in recognition of his services during the severe illness of the Prince of Wales; in 1881 he was elected president of the College of Physicians. He wrote a number of papers on specific diseases, and was the first to establish the difference in kind between typhus and typhoid fevers.

Jenolan Caves, a series of beautiful limestone caverns, on the Fish River, Westmoreland county, New South Wales, discovered in 1841. An area of about 6 sq. miles round them is reserved as a public park, and the caves are lighted by electric light.

Jephthah, one of the Hebrew judges, who defeated the Ammonites, but having rashly made a vow that if he was victorious he would sacrifice to God as a burnt-offering whatever should first come to meet him from his house, he was met on his return by his daughter, his only child, whom he sacrificed, in consequence, to the Lord (*Judges*, xi, 29–40). Some commentators have maintained that this meant devoting her to perpetual virginity in the tabernacle. Jephthah ruled six years as a judge and general (*Judges*, xi, xii). The sacrifice of Jephthah's daughter is the subject of oratorios by G. Carissimi (1660), Handel (1751), and Reinthaler (1870), and of a Latin drama by George Buchanan.

Jerbo'a (Dipus, &c.), a genus of small animals belonging to the ord. Rodentia or Gnawers, having extremely long hind limbs, which gives them an extraordinary power of leaping, so that their movement seems more like flying than running. The fore-limbs are armed with short powerful claws, with which they excavate their burrows and extract the roots on which they

Egyptian Jerboa (*Dipus ægyptius*)

chiefly live. They are gregarious and nocturnal in their habits, and hibernate during the colder seasons. The jerboas are found chiefly in Asia, Northern Africa, and North America. The typical species is the Egyptian form (*Dipus ægyptius*).

Jeremi'ah, the second of the great prophets of the Old Testament, flourished during the darkest period of the Kingdom of Judah, under Josiah, Jehoahaz, Jehoiakim, Jeconiah, and Zedekiah. He was called to the prophetic office about 629 B.C., in the reign of Josiah, and lived to see the capture of Jerusalem by Nebuchadnezzar in 586 B.C., who offered him a home at Babylon, but he preferred to stay amongst the wretched remnant of the people left in Judah. He is said to have been stoned to death in Egypt by some of his countrymen, who were infuriated by his rebukes. He wrote two Old Testament books, the *Prophecies of Jeremiah* and the *Lamentations*. The text of the prophecies is in a somewhat confused state, there being no chronological order. Jeremiah wants the dignity and splendour of Isaiah, but exhibits great tenderness and elegiac beauty of sentiment. In Hebrew the book of *Lamentations* is called *Ekhāh* (*How*, the first word of the book) and sometimes *Kinoth* (Dirges). Some critics also attribute to Jeremiah the book of *Deuteronomy* and several of the *Psalms*. See *Jews*.—BIBLIOGRAPHY: S. R. Driver, *Introduction to the Literature of the Old Testament*; T. K. Cheyne, *Jeremiah: his Life and Times.*

Jerez (or **Xeres**) (*he*-reth') **de la Frontera**, a town of South-Western Spain, in Andalusia, province of Cadiz, 16 miles N.N.E. of Cadiz. It is a well-built and flourishing town, with some handsome edifices, chiefly churches, and the Alcazar, an old Moorish castle in ruins. It is noted for its wine, well known under the name of sherry, which is exported in large quantities. A great battle was fought at Jerez in A.D. 711, and in 1362 Peter the Cruel had his wife, Blanche de Bourbon, murdered there. Pop. 62,600.

Jerez (*he*-reth') **de los Caballeros** (kȧ-vȧl-yā'rōs), a town of Spain, province of Badajoz, partly surrounded by a wall, which dates from the time of the Moors. Pop. 10,940.

Jericho (jer'i-kō), a considerable town of ancient Judea, on a plain about 18 miles N.E. of Jerusalem, noted, especially in Solomon's time, for its balsam-gardens and its thickets of palm trees and roses, and carrying on a flourishing trade in balsam and spices. It was the key of Palestine, and was therefore invested by the Israelites who had passed the Jordan under Joshua to conquer this country. Its site is now occupied by the small village of Riha. During the European War Jericho was captured by Lord Allenby's troops in Feb., 1918.

Jerobo'am, the name of two kings of Israel.—**Jeroboam I**, the son of Nebat, on Solomon's death (978 B.C.) was made king of the ten tribes who separated from Judah and Benjamin. He made Shechem his capital, forbade his subjects to resort to the temple at Jerusalem, and set up golden calves at the shrines of Dan and Bethel. He died in the twenty-second year of his reign.—**Jeroboam II**, the most prosperous of the kings of Israel, reigned 823–782 B.C. He repelled the Syrians, took their cities of Damascus and Hamath, and reconquered Ammon and Moab. But licentiousness and idolatry were prevalent during his reign. The authorities for the history of his time are *2 Kings*, *1 Chron.*, *Amos*, and *Hosea.*

Jer'ome, St. (Eusebius Hieronymus Sophronius), one of the most learned Fathers of the Latin Church, was born about A.D. 346 at Strido, near Aquileia, the capital of Venetia, of Christian parents. He was baptized in Rome before 366, went in 373 to Antioch in Syria, and in 374 retired to the desert of Chalcis, where he passed four or five years in severe mortifications and laborious studies. He left his solitude to be ordained presbyter at Antioch, went to Constantinople to enjoy the instruction of Gregory Nazianzen, and in 382 returned to Rome, where his expositions of the Holy Scriptures gained many adherents, especially amongst the rich and noble ladies, two of whom, Marcella and Paula, became celebrated for their piety. Paula accompanied him in 386 to Bethlehem, where their first work was to build a monastery and a convent, over which Jerome and Paula respectively presided. There Jerome remained until his death about 420. His voluminous writings include commentaries on the Bible, books on Church history and controversy, and letters. He took part in particular in the Origenist and Pelagian controversies. But his fame rests principally on his translation of the Bible into Latin from the original tongues; the version now known as the *Vulgate* is in the main the work of Jerome.—Cf. F. W. Farrar, *Lives of the Fathers.*

Jerome of Prague, a Bohemian reformer, born about 1360–70, in faith and sufferings the companion of the famous John Huss. Together they made a vigorous crusade against the dissoluteness of the clergy, and the worship of relics. When Huss was imprisoned in Constance, Jerome hastened to his defence, but was seized and carried thither in chains (1415). After much suffering he consented to recant his heresies, but on being subjected to a new examination solemnly retracted his recantation, and made a vigorous vindication of the principles of Huss and Wycliffe. On 30th May, 1416, he was burned at the stake, and his ashes thrown into the Rhine.—Cf. William Gilpin, *Lives of John Wicliffe and of the most Eminent of his Disciples.*

Jer′rold, Douglas, English humorist and playwright, born 1803, died in 1857. The son of the manager of Sheerness Theatre, he was for a short time a midshipman, and was afterwards bound apprentice to a printer in London. His first play, *More Frightened than Hurt* (1818), was not at first successful, but his *Black-eyed Susan* (1822) ran for 300 successive nights at the Surrey Theatre. Jerrold's subsequent dramas were: *The Rent-day, Nell Gwynne, The Housekeeper, The Prisoner of War, Bubbles of a Day, Time Works Wonders, St. Cupid, The Catspaw, The Heart of Gold*, and several others. He contributed extensively to periodical literature, founding and conducting successively *The Illuminated Magazine* and *Douglas Jerrold's Shilling Magazine*, and subsequently editing *Lloyd's Weekly Newspaper*. To *Punch* he contributed his inimitable *Mrs. Caudle's Curtain Lectures* and *Punch's Letters to his Son*. Though a master of satire and repartee, his sayings had no personal malevolence.—Cf. Walter Jerrold, *Douglas Jerrold, Dramatist and Wit*.

Jer′sey, the largest and most important of the Channel Islands, about 15 miles off the northwest coast of France; greatest length, east and west, about 12 miles; greatest breadth, 7 miles; area, 28,717 acres or 44·87 sq. miles. Its coast, particularly on the north, is extremely rugged and precipitous, is deeply indented all round, and has a number of good bays and harbours, the chief of which are St. Aubin and St. Helier. The island is fertile, abundantly wooded, and well cultivated. The climate is peculiarly mild and agreeable. Wheat is the principal cereal raised, and large quantities of grapes, peaches, melons, pears, and other fruits are exported, as also vegetables, and especially early potatoes for the London market. Cows of the famous Jersey or Alderney breed are reared and exported. The lower classes speak a sort of old Norman-French dialect, while French is the language of the upper classes and the law courts. Jersey is governed by a Lieutenant-Governor and a Bailiff, both appointed by the Crown, and has its own legislature, known as the ' States '. Appeals lie to the king in council. The island is attached to the diocese of Winchester. Principal town, St. Helier. Pop. (1921), 49,494. See *Channel Islands*.

Jersey City, a town in the United States, capital of Hudson county, New Jersey, on the Hudson, opposite New York, from which it is about a mile distant and with which it is connected by ferries. It possesses a number of large public and other buildings, notably the huge grain elevators near the river, the city hall, the court house and jail, various churches, and large public schools. The manufacturing establishments are very numerous, and comprise glass-works, boiler-works, foundries, steel-works, breweries, sugar-refineries, chemical-works, watch-works, tobacco-works, and potteries. Its population is largely made up of the overflow of New York. Pop. (1920), 297,864.

Jerusalem (Heb. *Yerushālayim*; Ar. *El-Kuds*, ' The Holy '), one of the most ancient and interesting cities in the world, in Palestine. It stands on an elevated site (about 2500 feet above the sea) within the fork of two ravines, the Valley of Jehoshaphat (or of Kidron) on the east, at the foot of the Mount of Olives, and the Valley of Hinnom on the south and west, while a third ravine or valley—the Tyropœon—partially traverses it from south to north. On the east side of this last valley is the traditional Mount Moriah, where anciently stood the palace and temple of Solomon. Immediately south of this stood probably the mountain fortress of Zion or City of David, but the view is also held that Zion or the City of David stood on the opposite or western side of the Tyropœon in the south-west of the present city, and to this the name of Zion is commonly given. Here are the Armenian quarter, the citadel, and the English church; north of the Armenian quarter is especially the Christian quarter. Of three walls built for the defence of Jerusalem, the first wall, that of David, was for the defence of the City of David and the older part of Jerusalem on the south. The second wall took in a considerable area on the north-west, while a suburb, Bezetha, which grew up on the north, was enclosed by a third wall, built by Agrippa I. The present limits are much the same as those indicated by the third wall, but considerable areas on the south (including the English school and cemetery) are outside the modern walls. There are seven gates, one being quite modern. The interior of the city is much occupied by mosques, churches, and convents. The houses are substantially built of stone, and present in most cases no windows to the streets, which accordingly—generally narrow, ill-paved, and sloping to the centre—are merely long lanes with dead walls on each side of them. In the north-west quarter is the Church of the Holy Sepulchre, so called because alleged to contain under its roof the very grave in which the Saviour lay. This church, which was built by Helena, the mother of Constantine the Great, is remarkable for the richness of its decorations and the number of pilgrims by whom it is visited. A large area in the east of the city is occupied by the enclosure known as El Haram-Esh-Sherif (The Noble Sanctuary), which is in the form of a regular parallelogram surrounded on all sides by a lofty wall. The most conspicuous building within is the Mosque of Omar, called also Kubbet-es-Sakhrah (Dome of the Rock), a splendid structure of octagonal form which occupies the site of the Jewish Temple. Amongst the notable convents are the Latin convent, and the still more extensive Armenian convent, capable of accommodating 1000 pilgrims. Within the last forty years or so a considerable improvement has taken place in the appearance of the city, as well as of the surrounding country. Hotels with all modern conveniences and comforts have been erected for the hosts of pilgrims and travellers who annually visit the place; and a railway now connects it with Jaffa. The water-supply is partly from rain-tanks, there being also a number of pools or reservoirs (that of Siloam lies south of the city, and the water is not very good). In 1901 iron pipes were laid bringing water from a spring 7 miles to the south, but the supply was still inadequate, and immediately after the occupation of the city by the British a new water-supply system was inaugurated. Till 1917 the city was governed by a 'Mutesarrif' immediately subject to the Porte. The joint Protestant bishopric, supported by England and Prussia, was dissolved in 1887, since when the English and German churches have been separately governed. The present pop. is about 60,000.

History.—Jerusalem is first mentioned by name on the cuneiform tablets from Tell el-Amarna (about 1400 B.C.). At that period subject to Egypt, it was at a later date in the hands of the Jebusites. From them the lower part was wrested by Joshua, but the upper part continued in their possession till the time of David, who took up his residence in the stronghold of Zion, and made Jerusalem the capital of his kingdom. It reached the height of its glory under Solomon, after whose time it declined. In 586 B.C. Nebuchadnezzar took and destroyed the city after a long siege, and carried off the inhabitants as captives to Babylon. The captivity lasted about seventy years, at the end of which the Jews were released by Cyrus. They returned to Jerusalem, and in 515 B.C. rebuilt the temple, though on a far less magnificent scale. The walls were not rebuilt till the time of Ezra and Nehemiah, 455 B.C. The city had regained a considerable degree of prosperity, when, on the dissolution of the Macedonian Empire, it was sacked by Ptolemy Soter, who transported a great number of the inhabitants to Alexandria. In 168 B.C. it was again sacked and its walls levelled by Antiochus of Syria, but under the Maccabees, whose exploits have made them the greatest heroes of Jewish history, Jerusalem, in common with Judæa, became once more independent (165 B.C.). It next became tributary to Rome, and had been greatly beautified and enriched with a fine new temple by Herod when the Saviour appeared. In A.D. 66 Jerusalem was taken by a party of Jews who had revolted against Rome. Titus, the son of the Emperor Vespasian, regained it in the year 70, after a terrible siege; the temple was burned, and the city razed to the ground. In A.D. 131 Hadrian ordered the city to be rebuilt, but the Jews, fearing profanation of the holy places, rebelled and took Jerusalem, which was only recaptured after a long struggle. It was then made a Roman colony, under the name Aelia Capitolina, and Jews were forbidden to approach it on pain of death. It continued thus depressed till the beginning of the fourth century, when, Rome having become Christian, Jerusalem shared in the benefit, and assumed the appearance of a distinguished Christian city, under the fostering care of Helena, mother of Constantine the Great. This period of prosperity, prolonged by a succession of Christian emperors, was suddenly terminated in 636, by the conquest of the Mahommedans, under the Arabian Caliph Omar. In 1099 the Crusaders took Jerusalem by storm, and made it the capital of a Christian monarchy, which with difficulty maintained its existence till 1187, when it was finally overthrown by Saladin. In 1517 Jerusalem fell into the hands of the Turks, and remained a part of the Ottoman Empire till 1917. On 9th Dec., 1917, the city surrendered to the British forces under General Allenby. On 11th Dec., Allenby made his official entry into Jerusalem, and the British High Commissioner for Palestine now has his official residence there. In 1918 a Hebrew university was founded on Mount Scopus, and the Jewish national life, in accordance with Mr. Balfour's declaration of 2nd Nov., 1917, has been revived. See *Zionism.*—BIBLIOGRAPHY: L. B. Paton, *Jerusalem in Bible Times*; Sir G. A. Smith, *Jerusalem*; C. M. Watson, *The Story of Jerusalem.*

Jerusalem, Holy Places of. The interest of Christians in identifying and visiting the spots consecrated by the presence of Jesus at Jerusalem did not awaken till the fourth century, when Helena, the mother of Constantine, the first Christian emperor of Rome, visited Palestine at the age of eighty, in fulfilment of a vow. Her journey to Jerusalem evidently accelerated the custom of pilgrimage, and various scenes of our Lord's passion were identified more or less precariously. Records of some eminent pilgrims have survived. From these, and from recent excavations, as well as from a critical study of the gospel narratives, attempts have been made to fix the site of certain events in connection with the last days of Jesus on earth. The difficulties are due to the stormy vicissitudes through which Jerusalem passed, especially during the Crusades; ecclesiastical interests also have often seized upon certain scenes, with little or no real foundation; and, again, the data of the gospels do not always warrant the conclusions drawn by some modern or mediæval investigators. However, the traditional holy places may be reckoned at about five, and approximately identified as follows.

(*a*) The discovery of a rock grave, alleged to have been the Holy Sepulchre, was made during Constantine's reign, and hailed with enthusiasm as a remarkable proof of the resurrection. Over it a church of the Sepulchre or Anastasis (Resurrection) was consecrated in 336. The vulgarities of the present church, which only dates from last century, have almost obliterated the original rock-tomb. Those who believe that this site originally lay inside the city wall prefer to locate the tomb farther to the north, at the hill over the grotto of Jeremiah. This is the so-called Garden (or Gordon's) Tomb.

(*b*) As the tomb was close to Calvary, the site of the latter is included in the church of the Holy Sepulchre, or at the knoll north of the Damascus gate. The latter has strong English support. Whether Calvary was really a hill at all is quite uncertain, however, and, in the words of Condor, " while it is probable that the site is that of Calvary, we must still say of our Lord as was said of Moses, ' No man knoweth of His sepulchre until this day '. This, indeed, is the general conclusion of recent writers, and even as regards Calvary we have only probabilities to consider " (*The City of Jerusalem*, p. 156).

(*c*) The Via Dolorosa, i.e. the route followed by Jesus from the judgment-hall of Pilate to the Cross, has been traditionally identified since the thirteenth century; but the identification is precarious, for not only is the site of Calvary quite uncertain, but the starting-point of the walk is obscure. All depends upon whether Jesus was condemned at the Castle of Antonia (as the traditional version assumes) or at Herod's palace; in the latter event, there could be only a few hundred yards to walk, unless Jesus was marched to the Castle of Antonia first, to join the two robbers. " However, the actual roadway which those sacred feet trod so painfully is some yards below the present surface ", and the thrill of associations is diminished by the uncertainty that the route taken actually corresponds to the present Via Dolorosa, which is " one of the most picturesque streets in the city, spanned as it is in parts by huge flying buttresses, passing up and down ancient stairways, and plunging through dark mysterious archways " (H. Rix, *Tent and Testament*, p. 205).

(*d*) According to a fourth-century tradition a little church was built as early as Hadrian's reign on the site of the house with the upper room, where Jesus instituted the Holy Supper. This is identified with the Cenaculum or Chamber of the Last Supper shown in the Moslem block of buildings called Nebi Daûd (' Prophet David '). But it is questionable if this room was the original meeting-place of the Church in Jerusalem.

(*e*) As for the garden or orchard of Gethsemane, the traditional site may have been fixed on the basis of some local information which survived till the fourth century. It is now held and conventionalized by the Franciscans. But " wherever it was—and the slopes have suffered much these nineteen centuries—any of the olive-groves on the Mount, which have not been dressed as the Franciscan garden has, will give the pilgrim a more natural impression of the scene of our Lord's agony than the latter can " (Sir G. A. Smith, *Jerusalem*, vol. ii, p. 571). In addition to the works cited, see Baedeker's *Palestine and Syria*; Sanday, *Sacred Sites of the Gospels* (1903).

Jester. Professional jesters, who depended for their livelihood upon their brains or lack of brains, seem to have been common in all ages, although the Middle Ages witnessed the greatest development of the art of the buffoon. There were professional fools in ancient Greece, and Philip of Macedon had a court fool. Lucian in his *Banquet* gives an account of the jesters of a later period. Among the Romans jesters were common. The jesters of the ancient world were nearly all dwarfs or deformed in some manner. Martial (vi, 39) mentions one whose head went into a peak and who had long movable ears, and elsewhere he speaks of another who looked like Hector if one only saw his head, and like Astyanax when he stood up. A revolting feature about the practice of keeping jesters was that their deformity was sometimes caused by artificial means, such as keeping them confined in a sort of frame, so as to make their appearance more comical and consequently enhance their value.

In the Middle Ages every large establishment had its jester, and fools varied in degree, from the court fool to the jester of the smaller landed gentry. The jester had a regular uniform. His head was shaved, his coat was motley, very frequently red and yellow in colour, and the legs of his hose usually differed the one from the other in colour. On his head was a special kind of cowl, fitted with bells and crested with a cockscomb. The fool's bauble, which he carried in his hand, was a short staff (like a sceptre or a field-marshal's baton) with a comical face on it; sometimes an inflated bladder was attached, and used for administering noisy but innocuous castigations.

Among celebrated English court jesters the following may be mentioned: Scogan, the jester of Edward IV; Will Somers, of the time of Henry VIII; Archie Armstrong, of the time of Charles I; and Muckle John, also of the time of Charles I, and probably the last official royal fool. There do not seem to have been any court fools appointed after the Restoration; they did not outlive the Commonwealth. Charles II seems to have been content with appointing a poet-laureate, which he did in 1670. The last private jester on record was Dicky Pearce, who belonged to the household of the Earl of Suffolk. He died in 1728, and Swift wrote his epitaph. Some jesters seem really to have possessed a caustic wit, which was given complete freedom by their position; others seem to have been merely odd, and to have depended upon their eccentric appearance for much of their fun. A jester who took his profession seriously found his task no sinecure, as Shakespeare confesses (*Twelfth Night*, iii, 1, 69):

> He must observe their mood on whom he jests,
> The quality of persons and the time,
> And, like the haggard, check at every feather
> That comes before his eye. This is a practice
> As full of labour as a wise man's art.

—Bibliography: John Doran, *The History of Court Fools*; Francis Douce, *Illustrations of Shakespeare*; E. K. Chambers, *The Mediæval Stage*.

Jes'uits, or Society of Jesus, the most celebrated of all the Roman Catholic religious orders, founded in the sixteenth century by Ignatius Loyola, and established by a Papal Bull in 1540, the founder being the first *general* of the order. The members, in addition to the usual vows of poverty, chastity, and implicit obedience to their superiors, were bound by a fourth, viz. to go whithersoever the Pope should send them, as missionaries for the conversion of infidels and heretics, or for the service of the Church in any other way. The Popes Paul III and Julius III, seeing what a support they might have in the Jesuits against the Reformation, granted to them privileges such as no body of men, in Church or State, had ever before obtained. They were permitted to enjoy all the rights of the mendicant and secular orders; to be exempt from all episcopal and civil jurisdiction and taxes, so that they acknowledged no authority but that of the Pope and the superiors of their order; to exercise every priestly function, parochial rights notwithstanding, among all classes of men, even during an interdict; and they could absolve from all sins and ecclesiastical penalties, dispense themselves from the observance of fasts and prohibition of meats, and even from the use of the breviary. Their general was invested with unlimited power over the members, the dispersion of whom throughout society, with the most entire union and subordination, was made the basis of the order. The Constitution of the body was drawn up in great part by Loyola himself, but the second general, Laynez, had much to do in directing its early movements.

The order soon approved itself to the Pope by its zealous activity, and its success as the most effectual barrier against the growing power of Protestantism. The Jesuits carefully avoided all appearance of spiritual pride, often wore the ordinary garb of the country, and generally dealt with all matters in a spirit of worldly policy and accommodation to circumstances. Their grand object was the establishment of the Papal power, not only against Protestanism, but against all the claims of kings and national Churches. In 1541 their foreign missions were begun by Francis Xavier in the Portuguese East Indies, and were attended with great success. Other Jesuits went to South America, and laboured successfully in Brazil and Paraguay. In Europe they became the teachers of the higher classes, and carried out, on a grand scale, improvements in the current system of instruction. The young nobility were almost exclusively sent to them, even from Protestant countries. It was in Catholic countries, however, that their strength lay; in England and the Protestant states of the north they were not so successful, their repeated attempts to establish themselves there proving fruitless.

Yet notwithstanding the great favour which they enjoyed at courts and among the people, the non-Jesuit clergy, the older order of monks, the universities, and the learned men of the age soon began to dread the powerful influence which the society was rapidly acquiring, while their busy intriguing spirit made them the objects of suspicion and jealousy to statesmen, on account of their interference in political affairs. For this reason the Parliament and higher clergy of France for twenty years resolutely resisted the attempts of the Jesuits to gain a footing in that country. It was owing chiefly to the favour of the Guises that they at last, in 1562, were legally recognized in France under the name of *Fathers of the College of Clermont*, with a humiliating renunciation of their most important privileges. They appeared in Germany about 1549, and soon secured chairs in the Universities of Prague, Ingolstadt, Cologne, Munich, Treves, Augsburg, and other places. They showed remarkable political talent in the Thirty Years' War; the league of the Catholics could do nothing without them. But while they were thus successful in this part of Europe, in France and the Netherlands the Jansenist controversy injured their position, and the character of the Jesuits received a fatal wound from the pen of Pascal, whose famous *Provincial Letters* exposed with admirable wit and argument the dangerous element in their doctrines and practices, the accommodating morality which allowed interest and external circumstances to determine the rule of conduct, which counselled evasiveness and mental reservations, and consecrated evil means for a good end.

Towards the middle of the eighteenth century the general sense of danger from the Jesuits, and of the incompatibility of their privileges with the authority of the State and the rights of others, prompted a movement against them in various countries. In 1759 the efforts of the minister Pombal brought about their expulsion from Portugal, and the confiscation of their possessions in that country. In France the commercial complications of a Jesuit trading-house at Martinique with some French merchants led to an inquiry which brought to light many abuses. Louis XV tried to save the society by demanding a reform of its Constitution, a demand refused by the general of the order, Lorenzo Ricci, in the famous terms, " *Sint ut sunt, aut non sint* " (Let them be as they are, or cease to be). The result was a decree issued in 1764 for the abolition of the order in all the French possessions. Three years later they were expelled from Spain, and soon after from Naples, Parma, and Malta; and finally in 1773 Pope Clement XIV was induced to publish his famous Bull *Dominus ac Redemptor Noster*, by which the Society of Jesus was totally abolished in all the states of Christendom. They were obliged to quit their houses, lay aside the garb of the order, renounce all intercourse with one another, and either enter some of the other orders or put themselves under the superintendence of the bishops. They received annuities from the revenues of their confiscated estates, except in Portugal, in which country they were prohibited from residing, as also in Spain; while in the States of the Church, in Upper Italy, and in Germany, Hungary, Poland, and even in France they were suffered to remain as private persons. An attempt in 1787 to revive the society under the name of *Vicentines* was unsuccessful; but in 1814 Pius VII issued a Bull (*Solicitudo omnium Ecclesiarum*) which re-established it in precisely the same form in which it had fallen. In 1815 a college was given them at Modena, and they did not delay to accept the invitations of the Kings of Sardinia, Naples, and Spain. Subsequently they found entrance into all European countries. In Italy, since the establishment of the new kingdom in 1861, the Jesuits have no legal existence, but continue, nevertheless, an influential and well-known body. In Britain they have been permitted to open educational institutions, the principal of which are at Stonyhurst, near Preston, in Lancashire; Mount St. Mary's College, near Chesterfield, Derbyshire; Beaumont Lodge, near Windsor; and St. Benno's, at St. Asaph, in North Wales. In Ireland and in Scotland they have also several institutions. They have also colleges in the United States and in Canada. It was under the influence of this order that the Œcumenical Council of 1870 was held, and they have had a decided influence in shaping the recent policy of the Papal authorities. By the law of the 4th of July, 1872, they were expelled from the German Empire, to the erection of which they had shown the utmost hostility. In 1880 they were expelled from their conventual establishments in France, and a considerable number of them came to Britain.—Bibliography: J. Crétineau-Joly, *Histoire religieuse, politique, et littéraire de la Compagnie de Jésus* (English translation by B. N., *The Jesuits: their Foundation and History*); W. C. Cartwright, *The Jesuits: their Constitution and Teaching*; Stewart Rose, *Ignatius Loyola and the Early Jesuits*; G. B. Nicolini, *History of the Jesuits: Origin, Progress, Doctrines, and Designs*; Joseph M'Cabe, *Candid History of the Jesuits.*

Jesus. The name was in Greek the equivalent for ' Joshua '; indeed the great general of the Hebrews is actually called ' Jesus ' by the English version of 1611 in *Heb.* iv, 8. It was not an uncommon name among the Jews, and we know of at least one early Christian who was called by this name, a companion of Paul (" Jesus, who is called Justus ", *Col.* iv, 11). But the name is pre-eminently associated with the Jesus who became the founder of the Christian religion. In His case the name was found specially appropriate. Literally it meant ' Jehovah saves ', and Jesus, according to one story (*Matt.* i, 21), was so called by a divine prompting, as He was to ' save His people from their sins '.

The date of His birth is uncertain, but it may have been between 6 and 4 B.C. His parents, Joseph and Mary, belonged to the lower division of the province of Galilee, to the north of Palestine, farther from Judea than Samaria was, yet closer in faith and blood; for although the orthodox Jews of Jerusalem and the south might look down upon the accent and the mixed racial qualities of the Galileans, and suspect their strictness in religion, the Galileans were true to the law, and often proved themselves passionately devoted to the interests of Judaism, particularly when these took the form of a Messianic crusade. Certainly the parents of Jesus went regularly to Jerusalem to attend the annual spring celebration of the passover. It was a religious household in which Jesus was brought up, with an atmosphere permeated by the best traditions of Jewish piety. The home of His parents was at the hamlet of Nazareth, on the slope of a high valley facing the north side of the Carmel range, and almost half-way between the Mediterranean and the Lake of Galilee. There Jesus received the ordinary education of a country boy at the school connected with the local synagogue. He was trained to Joseph's trade, that of a carpenter or builder. His parents were of humble origin; Jesus was the eldest child, but there was a large family of sons and daughters. Joseph seems to have died early. The sisters were married in the neighbourhood, but Jesus never married. Till he was over thirty He remained unknown beyond His district, working at His trade. Echoes of the great outside world must have reached Him, for Galilee was busy with trade and commerce, but He made no effort to study as a rabbi or to abandon His provincial life for a career elsewhere. He may have known some Greek, but His language was Aramaic, the vernacular dialect of Galilee. So the first phase of His life passed.

Until about A.D. 27 nothing was heard of Jesus outside the hamlet and district of Nazareth. Then news reached the locality of a revival movement in the far south. Judæa was being roused by the vigorous preaching of a priest's son called John. He had the prophetical gift of an Amos or a Micah, and the religious awakening which followed his mission drew people of all classes and from many quarters. Among them some Galileans hurried down to the banks of the Jordan, where John was accustomed to insist upon his converts dipping themselves in the river as a symbol of the clean life to which they had committed themselves. The summons was for a radical, practical repentance, in view of an imminent judgment of God. John denounced the sins and shortcomings of his age, like a Savonarola. His demand upon the conscience of his hearers roused some fishermen from the Lake of Galilee and Jesus Himself, who underwent a deep religious experience of His own when He was immersed at the Jordan. He now became fully conscious of a divine mission to His age and nation, larger than that of any revival preacher. He believed He was the Son of God, with a Messianic vocation. A period of meditation followed, in which He thought out His position and determined His course. Then He returned to Galilee. Meantime, John was arrested by Herod Antipas, the tetrarch of Galilee, who presently put the audacious prophet to death. The revival movement of John was thus checked, although some of his adherents still clung together. But it was replaced and enlarged by the movement which Jesus now started in the north. He came forward with an ampler message and mission. Unlike John, He was not an ascetic. He moved freely among all sorts of people, and denunciation was not the staple of His teaching.

He began by attaching to Himself four of the fishermen from Galilee who had already been influenced by John. These men He summoned to accompany Him in a new enterprise, a mission of teaching and healing in the district round Capernaum. His head-quarters were at the house of Simon Peter, the most prominent of the four, and the range of His mission covered the adjoining villages and townships. The success of the mission was at first remarkable. The countryside thrilled to His appeal, and apparently the reputation He won reached even Jerusalem. Eventually he added eight to the original four personal companions of His fellowship, and sent them out on a mission of their own to carry the good news of God throughout the province. This was the hey-day of His popularity. He made religion simple and real. His personality won devotion to Himself and to His cause. His religious genius, His new message of God the Father, His power of teaching, and the enormous impression made by His cures—for He travelled about as a *hakeem* or healer as well as a teacher—all this made a deep and sharp impression for a while.

Presently, however, the popularity waned. The authorities became suspicious of His attitude to the strict regulations of Jewish piety; for although Jesus confined His mission to Jews and upheld the law and the prophets, He was indifferent to the ceremonial and ritual regulations which had grown up around the faith. He openly repudiated the hard interpretation of the Sabbath, for example, and criticized freely the traditional regulations and rules which the authorities identified with true religion. This generous attitude did not lessen His popularity with the masses, it is true, but many of them began to realize the strenuousness of His ethical demands. His fervour even led some, including His mother and family, to regard Him as insane. Also, the murder of John by Herod indicated that, although Jesus abstained from any political preaching, the tetrarch might take similar measures on behalf of the authorities against this unflinching Prophet of Galilee. Jesus, therefore, withdrew for a time to the north. Except for this hurried retreat, He never left Jewish soil during His life. But a critical moment had arrived, and during this period of wandering He resolved to alter His method. Hitherto He had in the main confined Himself to the northern Galilee. Now He determined to make a final appeal to the nation at head-quarters and to enter Jerusalem, convinced that only by thus risking His life and enduring suffering for the cause could He accomplish the regenerating work of God. Probably this was about A.D. 29. He disclosed to the inner circle of His followers the secret conviction of His soul that He was the divine Messiah, and that as such He must encounter death for the sake of the cause of God. Indeed His main attention at this point is given to the disciples, whom He endeavoured to train for the future work that will await them, and to prepare for the coming tragic fate that will befall Him. He endeavours to assure them that the hope and future of the cause are safe with God, and that death will not interrupt His power and presence with them.

He entered Jerusalem as the spring celebration of the passover was due. Scenes of enthusiasm occurred. The Galileans cheered their Prophet into the holy city. But the authorities were suspicious and alert. Jesus challenged them boldly. His answers and questions were damaging to their authority, and they feared a Messianic rising, which would compromise them with the Romans. One of His disciples for some reason was willing to betray Him into the hands of the Jewish rulers. Late one evening He was arrested in a garden near the city, hurriedly tried, and condemned by the Jewish council upon a charge of blasphemy, and then brought before the Roman Governor to have the sentence ratified. The Governor was induced against his will to let the malignant Jews have their way, the reason being that Jesus was a dangerous political agitator. As such, as a leader of revolt, He was formally sentenced to death, and at once crucified along with a couple of brigands. The execution took place upon a Friday. By the following Sabbath His body had disappeared from the tomb in which some of His adherents had been allowed as a favour to deposit it. The Jews alleged that it had been removed by His adherents themselves. The latter maintained that Jesus had returned from the dead, resumed His body, and appeared to several of them in supernatural form. This belief spread among His adherents, and out of their faith the Christian community arose.

Such, in bare historical outline, is a summary of the outward career of Jesus upon earth. He wrote nothing Himself. All that is known about Him has come down from recollections preserved by the tenacious Oriental memories of His followers. These are recorded in four small books of ‘ Gospels ’, which contain the Christian interpretation of His career and character. Little else has survived of any historical importance, and even the contents of the four Gospels are not always ‘ historical ’ in the strict modern sense of the term. They were written for those who already believed, to train them in the religion which Jesus had founded, to show how that religion differed from Judaism, and to expound its essential principles in the very words of the Master Himself. What was fundamental was the belief that Jesus had been the Son of God, not an ordinary man, but divine; not even the traditional Jewish Messiah, but one who fulfilled that rôle as the Son of God through suffering and death, bringing to the world life eternal and a final revelation of God. This belief was expressed in various ways. Some thought that He was born of Mary before her marriage was consummated, and beautiful tales were told about His childhood. He was further credited with supernatural powers over nature and disease, which extended occasionally to raising dead persons. Also, His own death was marked by extraordinary phenomena. It is one problem of historical criticism to explain the origin and meaning of such traditions. But the substantial historicity of the records is no longer to be doubted. The production of such a picture as the sketch of the personality and teaching of Jesus in the Gospels is incredible as the mere outcome of pious reverence or of the mythopoetic faculty. Even after fair allowance is made for the idealizing tendencies of devotion, and for the difference between various strata of the tradition in point of historical probability, the fact remains that the early Christian movement is unintelligible apart from some such historical mission of Jesus as the Gospels reflect. Reverence has entered naturally into the retrospect now and then; later reflection has heightened occasionally the original record and intensified the colouring of the supernatural. But the description of what Jesus did and of what He was is not the result of a vague effort upon the part of enthusiasts to deify a noble Prophet who had been prematurely put to death. The Gospels are far from complete, judged by the standards of biography. Long spaces of the life are passed over. The only week of which we have any detailed knowledge is the last week of His life. “ On the very shortest estimate the length of the ministry must have extended to about 400 days, and I doubt if our Gospels contain stories from 40 separate days. So that nine-tenths at least of the public life of Jesus remains to us a blank, even if we were to take every recorded incident as historical and accurately reported. And all the recorded sayings of Christ, how long would they take to pronounce? With due gravity and emphasis they might take six hours—hardly, perhaps, so much ” (Burkitt, *Transmission of the Gospels*, p. 20). But the materials, although scanty and fragmentary, yield what is salient and characteristic. The precise limits of the supernatural in His personality and career form an unsolved, probably an insoluble, problem. But that Jesus actually lived, that He believed Himself to be sent into the world for a unique divine vocation, that He was conscious of being in some sense God’s Son as no one else could be, and that He did appear after death to His disciples, not as a ghost and still less as one who was merely resuscitated—this is certain, as certain as anything which rests upon human testimony can be.—BIBLIOGRAPHY: From the vast literature upon the teaching, miracles, self-consciousness, and environment of Jesus, it is only possible to select here a handful of references to works describing more or less fully His actual life, (*a*) the best being Keim's *Jesus of Nazara*, with (on a smaller scale) Renan's *Vie de Jésus*, Oscar Holtzmann's *Life of Jesus*, Edersheim's *Life and Times of Jesus the Messiah*, S. J. Andrews's *Life of Our Lord*, Seeley's *Ecce Homo*, Bousset's *Jesus*, Sanday's *Outlines of the Life of Christ*, P. Didon's *Jesus Christ*, G. H. Gilbert's *Student's Life of Jesus*, and J. Stalker's *Life of Jesus Christ*; (*b*) some works describing recent discussion, like Schweitzer's *Quest of the Historical Jesus*, Sanday's *Life of Christ in Recent Research*, and Weinel and Widgery's *Jesus in the Nineteenth Century and After*; with (*c*) a few books upon special features, such as Bruce's *Training of the Twelve*, Loisy's *Jésus et la Tradition évangélique*, Denney's *Jesus and the Gospel*, Batiffol's *Credibility of the Gospels*, S. J. Case's *Historicity of Jesus*, E. F. Scott's *Kingdom and Messiah*, and T. R. Glover's *Jesus of History*.

Jesus College, Cambridge, was founded by Alcock, Bishop of Ely, in 1496. Its site was previously occupied by the Benedictine nunnery of St. Radigund, and parts of the old nunnery still remain, including the church, which has been converted into the usual form of college chapel. Among many famous men educated at this college may be mentioned Cranmer, Sterne, and Coleridge.

Jesus College, Oxford, was founded by Queen Elizabeth in 1571. Many of the fellowships and scholarships are confined to persons born or educated in Wales. The college is thus distinctively the Welsh one. This was the first college founded on Protestant principles. The Earl of Pembroke is the hereditary visitor of the college.

Jet, a hydrocarbon compound allied to Cannel Coal, and found chiefly in beds of Upper Lias shale at Whitby, in Yorkshire. Like amber, it becomes negatively electric by friction and takes on an excellent polish. At an early period it was given, like amber, a magico-religious value. Bede says that when heated jet drives away serpents. Until comparatively recently jet was in Scotland dipped in water to effect magical cures. Siret has found British jet associated with Baltic amber and Egyptian and Babylonian artifacts among the relics of the Eastern colonists who settled in Southern Spain long before the introduction of bronze working in Western Europe. In South-Western England jet and amber are associated with the Egyptian blue beads of the Empire period (*c.* 1300 B.C.) identified as such by Professor Sayce and Dr. H. R. Hall. There are a number of jet ornaments in the British Museum among the Bronze and Iron Age antiquities, one of the most beautiful being a necklace from Melfort, Argyllshire. The exportation of jet from Britain is referred to by Solinus (*c.* A.D. 80).

Jet-propulsion, a system of propulsion which uses the reaction of a jet of fluid as the driving force. A familiar example is the rocket. The system has often been proposed for marine propulsion. The Admiralty carried out experiments on a jet-propelled ship, the *Waterwitch*, in 1866. In the year 1881 trials were carried out on two small life-boats of the same size and scantlings, one being propelled by water-jets and the other by means of screws. The efficiency figures worked out as follows: screw boat, engine 77 per cent, screws 65 per cent; jet-propelled boat, engine 77 per cent, jets 71 per cent, pumps 46 per cent. The equipment in the jet-propelled boat consisted of a set of main engines driving a centrifugal pump, which sucked water through an inlet pipe pointing forwards and expelled the water through stern pipes aft. The loss of efficiency is plainly due to the pump, and it has been thought by certain engineers in recent times that improvements in pump design might materially alter the relative efficiencies. Generally speaking, the system is less efficient than that of screw propulsion, because to get pipes and pumps of reasonable size and efficiency fairly high water speeds must be used; whereas, for high jet efficiency, low water speeds are essential. The system has never yet been used as a commercial competitor with the screw, but for certain special uses, mainly naval ones, it possesses advantages over the screw system. For instance, this 'drive' is said to be much more silent than the drive by screw, and this point is in its favour for anti-submarine boats of all kinds. The thrash of a screw gives away the position of the vessel carrying it to a listening submarine. Further, in certain circumstances, the jet pumps could be used to pump out the boat, in the event of a torpedo-wound, without impairing the propulsive power. Again, there is no screw to foul mine ropes, &c. It is also specially suitable for use in shallow and weedy waters, and has been investigated for that and similar purposes by the Gill Propeller Company (*The Motor Boat*, 12th Nov. and 24th Dec., 1920). In spite of these points no special use appears to have been made of the system during the European War.—Cf. Sir William White, *A Manual of Naval Architecture*.

Jetsam (A.-Fr. *jetteson*; Lat. *jactare*, to cast), goods found at sea after shipwreck, under water and unsecured. According to Lord Coke, jetsam is "when a ship is in danger of being sunk and, to lighten the ship, the goods are cast into the sea, and afterwards, notwithstanding, the ship perishes". When the ship is lost and the goods float, it is 'flotsam' (O.Fr. *floter*, to float);

when they are cast into the sea and sink, but have been secured by a buoy or cork to facilitate their recovery, it is 'ligan' (Lat. *ligamen*, a band). All such goods fall to the Crown, but are returned to the owners if claimed within a year.

Jetty, Pier, and Mole, terms employed to denote any structure which projects abruptly from a land-line into the water.

A 'mole' is generally understood to be of the nature of a breakwater, but strictly speaking it may be considered a mole only when it is provided with a quay on the sheltered side.

A 'pier' conveys the idea of carrying a load, or affording a convenient platform for transferring passengers and merchandize from ship to shore, or vice versa. Both moles and piers of these types are frequently called jetties.

'Jetties' are also to be found projecting from the sides of docks. They must be of sufficient width to accommodate the railways, cranes, and sheds required for handling cargo. By their use the quayage and the dock accommodation are increased. Good examples are to be found at Marseilles, in the Thames at Tilbury and Victoria Docks, in the Clyde, and at the Alexandra Dock, Hull.

Another use for jetties is illustrated at the mouth of the Mississippi and at Tampico, where parallel jetties are formed constricting the exits of the rivers and so concentrating the volume of flow as to clear away obstructions in the navigation channels. Parallel jetties are also constructed at Ostend, Dunkirk, Calais, and elsewhere to concentrate the scouring action of the tides.

The jetties at Tampico and the Mississippi are constructed of mounds of rubble in layers interspersed with fascine or brushwood mattresses, and are surmounted by a crest-wall of concrete. Those at Ostend and Dunkirk are formed of low mounds with pitched surfaces rising only a few feet above beach-level, and are surmounted by a timber framework supporting platforms, at the outer ends of which are the guiding lights for the harbour entrance.

Jetties are also used at entrances to docks from estuaries and rivers. In this type they widen out towards the river, and afford protection from the current. Tilbury tidal-basin is provided with such jetties.

When jetties are built as piers on a more or less exposed coast, they are usually made of open framework, and the deck or platform is of such height above water-level as to allow the waves to expend themselves through and underneath the structure. They are therefore not exposed to the full wave force, whereas a jetty of solid construction would present its whole area to the wave-stroke, and would consequently be very costly to build. The force of waves was measured at Dunbar by wave dynamometer and found to be as much as 3½ tons per square foot. Jetties of solid construction have also the disadvantage of blocking access along a beach, and trapping the littoral drift, causing the ultimate silting up of one side of the jetty.

Piers of the open-framed type may be constructed entirely of timber, but are frequently made with cast-iron piles supporting steel girders or timber beams on which the platform is carried, all being strongly framed together. Reinforced concrete is used, and if well constructed the steel reinforcement should be protected by the concrete, as any exposed steel or iron will corrode in sea-water.

The jetty or mole at Zeebrugge is a good example of the solid type—in this case formed with arches over the beach.—BIBLIOGRAPHY: Brysson Cunningham, *Dock Engineering*; *Harbour Engineering*; Colson, *Dock Construction.*

Jev'ons, William Stanley, an English writer on logic and political economy, born at Liverpool in 1835, died in 1882. He was educated at University College, London; held an appointment in the Royal Mint in Australia from 1854 to 1859; graduated at London University in 1862; was appointed professor of logic, mental and moral philosophy, and Cobden lecturer on political economy in Owens College, Manchester, afterwards professor of political economy in University College, London, a post which he resigned in 1881. Amongst his works are: *Elementary Treatise on Logic* (1870), *Theory of Political Economy* (1871), *Principles of Science* (1874), and many essays and addresses on economic questions. Those entitled *The Coal Question*, *The Value of Gold*, *Money*, and *The Mechanism of Exchange* may be specially mentioned. He was drowned while bathing near Hastings.